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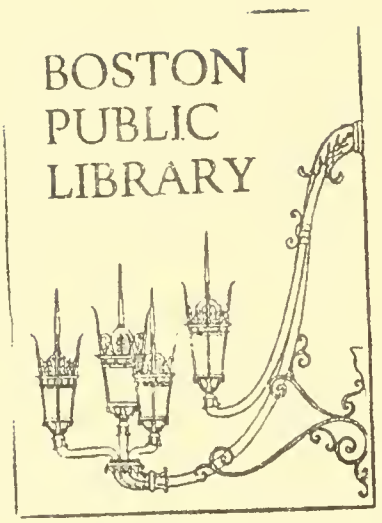
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A REPORT ON DORCHESTER BAY DEVELOPMENT

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

BOSTON REDEVELOPMENT AUTHORITY

24 JANUARY 1969

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PREFACE

On June 1, 1968, the M.I.T. Urban Systems Laboratory initiated an informal joint effort with the Boston Redevelopment Authority in the area of new community development. A basic objective of the initial informal effort was to explore ways in which the professional, technical, and research resources of the Institute could be brought to bear on the complex problems of community development in the city of Boston.

As a specific case study, the community development opportunities offered by the Dorchester Bay area in Boston Harbor was jointly explored. The initial contribution of the Urban Systems Laboratory was to utilize the case study as a mechanism to test and illustrate the application of selected advanced methods and new approaches to urban systems planning and design. In addition, very practical engineering considerations coupled with broad sociological goals were emphasized.

This preliminary draft of the report on our studies to date is submitted for comments and criticism on the work that we have already done, and we want to use the report as a concrete foundation for developing with you the scope of our joint activities from now until July 1, 1969. We know that you will have some specific questions: for example, about the engineering aspects of the site development, which are applicable both to the World's Fair studies and to the studies pertaining to some sort of ultimate urban development of the site.

It is perhaps pertinent to emphasize to all readers of this report that M.I.T.'s portion of the joint M.I.T./B.R.A. studies does not, by itself, constitute a feasibility study, although most of our research and analysis will be directly applicable to the overall feasibility studies that the B.R.A. is making for the development of Dorchester Bay.

During the summer of 1968, an M.I.T. study group undertook a study of the entire harbor for the Boston Harbor Islands Commission. As we have made clear to both the B.R.A. and the Harbor Islands Commission, some of the same people worked on both studies and we have drawn on some of the Harbor Islands Study results in preparing this report. The M.I.T. people who were responsible for the final Harbor Islands Report have studied the enclosed draft and we believe there is no inconsistency between the two reports, although there is inevitably some difference in emphasis, since the Harbor Islands Report treats the entire harbor and the enclosed report treats only a small section of the harbor.

A main emphasis of this report has been to raise as many questions as possible. We have not had time yet to answer, or even to attempt to answer, all these questions. However, we believe that by raising these questions we may provide a sounder basis for establishing some priority for our future joint activities.

Dr. Ronald Hirschfeld and Dr. Fred Moavenzadeh, serving as USL Project Engineers for the joint efforts, are supervising this project. The report is a product of the staff efforts during the past several months. The splendid cooperation of Mr. Charles Hilgenhurst, Assistant Director of the Boston Redevelopment Authority, is gratefully acknowledged.

C.L. Miller, Director
Urban Systems Laboratory

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INTRODUCTION

This report attempts to summarize MIT's efforts since June 1968 working in cooperation with the BRA on the problems associated with the future of the City of Boston. In particular, this investigation has been directed towards

--An analysis of the city's needs and how they might be addressed in the Dorchester Bay site.
--An engineering study of the site.
--An investigation of various developmental strategies for site development, concentrating upon the World's Fair as a development vehicle.

It is intended that this work complement that being carried out by the BRA concerning the development of Dorchester Bay. MIT's contribution is not a feasibility study; it is an analysis of some of the principal engineering, economic, social, and political issues inherent in large-scale development of the site. Some of these identical issues have been discussed in another MIT report, The Harbor Islands, which was prepared for the Harbor Islands Commission and is now nearing completion. That report, based on a study conducted last summer, was much broader in scope in that it viewed the entire Boston Harbor system. This report, for the BRA, focuses on a much smaller portion of the Harbor -- Dorchester Bay -- but draws upon work done for the first report. Some material is similar in both reports; both the BRA and the Harbor Islands Commission are aware of this. The difference in perspective between the two studies may result in slightly different inter-

pretations with respect to specific details, but the overall conclusions of the two report are essentially in harmony.

While the preliminary findings included in this report may be subject to later revisions, the report does summarize our analysis at this stage in the collection and interpretation of data. This is only a preliminary draft, intended for internal review purposes.

SUMMARY

In the past twenty years, a distinct change in the character of the Boston metropolitan region has occurred. An outward shift of people, commerce and industry toward the periphery of the region has produced a growing dichotomy between the cities and towns of the urban core (Boston, Brookline, Cambridge, Chelsea, Everett and Somerville) and those of the suburban ring. As the ring communities have become more affluent, more middle class and more confident of future prosperity, the core has become relatively poorer, increasingly divided by social conflict and less able to provide for the welfare of its residents.

Within the City of Boston, these problems are particularly visible. Population has fallen by 20 percent since 1950, reflecting the out-migration of the more affluent to the suburbs. The residents of the city who remain are generally older, less well educated, and have relatively fewer employment skills and lower incomes. Housing choices in Boston are extremely limited for the lower to middle income groups; no new housing has been built for these markets in recent years and older housing is continually being destroyed. The large supply of substandard housing within the city, estimated at up to 20 percent of the total stock, must remain in use to satisfy the shelter needs of the lower to middle income groups. New housing constructed for ownership is also lacking, forcing many of those who desire homeownership to seek suburban locations. The additions that have been made to the housing stock are largely upper income apartments, although some moderate income, 221(d)3 units have been built. A dwindling housing supply and restricted choices have pushed Boston's housing costs, relative to income, to the highest in the Nation.

The nature of Boston's economic base is changing as many of the manufacturing and wholesale industries have moved out of the city. Relocation of business, due to urban renewal and highway construction, has caused some of this loss; other firms have moved as part of the larger trend toward suburban locations. In order to encourage relocated firms to remain in Boston, attention should be given to meeting their needs for space and location in other parts of the city.

The altered character of the city's employment base -- an expansion of white collar professional jobs and a decrease in manufacturing and lower skilled jobs -- has exacerbated the problems of poverty in Boston. Although unemployment levels are low, sub-employment levels are high, especially within Roxbury. Expanded employment opportunities in the suburbs are seldom accessible to the central city resident.

Because the vast majority of the black population in the region resides in Boston, the problems of the city place porportionately greater pressures upon them. Negroes demand a higher degree of control over their own neighborhoods in an effort to cope with their problems because, thus far, the city government has not been able to ease this strain. Lower income white families within the city also suffer from housing and employment problems, higher taxes and a relative decline in the quality of municipal services. A growing level of discontent has become more apparent among many of these groups.

Part of this frustration stems from the structure of Boston's political system, which is dependent upon a city council elected "at-large". Representation is thus denied many of the smaller groups within the city and, until 1967, even the Negroes were unable to elect a council member from their own race. Somehow, a wider degree of citizen participation in the political process should be sought, perhaps through decentralizing some of the functions of the city government. While the majority of these problems are centered within the City of Boston, they are, in may ways, manifestations of larger structural changes within the metropolitan economy and pattern of population distribution. Solutions on a wide scale must be sought; a comprehensive approach which invites broad participation has been suggested in the development of Dorchester Bay. The open space of the bay represents a resource of great potential value, both to the City of Boston and to the entire metropolitan region, and it offers a unique opportunity for addressing our many urban problems simultaneously. The creation of a new community on the site, perhaps preceded by a World's Fair, could be a powerful tool for alleviating partially the growing regional imbalance between core and ring and provide impetus to further economic expansion.

The engineering design of either a community or a World's Fair at the Dorchester Bay site will be constrained by such factors as: geography, geology, quality of the marine environment, access to the site, and proximity of other commercial or public

activities, notably Logan Airport. Other constraints may be imposed by the character of the development itself, e.g. by landfill requirements, transportation requirements, or unusual demands for utilities and other services.

The geography and geology of the site determine the amount and location of usable land and the foundation conditions at these locations. To some extent the geography may be altered by landfill or by platforms supported on piles. In general, landfill is initially less expensive than platforms. In shallow water (5' - 10') landfill is expected to cost approximately $2.00 to $3.00 per square foot for hydraulic clay or $3.00 to $4.50 per square foot for sand. Platforms are expected to cost $10 to $15 per square foot, exclusive of piling costs. However, in some configurations, landfill may alter the direction and velocity of tidal flow, possibly resulting in increased erosion at nearby beaches, or water pollution.

Limited knowledge of the offshore geology of Dorchester Bay prevents us from reaching detailed conclusions regarding foundations. Deep bedrock and compressible subsoils are characteristic of the Boston Basin, and the sparse data which is available shows similar conditions in parts of Dorchester Bay. On the other hand, Thompson Island is reported to contain firm glacial deposits, suggesting that relatively good foundation conditions exist on and immediately adjacent to this island. The cost of foundations on Thompson Island would probably not

be significantly different from the cost of foundations on Beacon Hill. In other areas, where bedrock is deep and overlain by compressible soils, foundation costs may be as high as they are in places where such conditions have already been encountered in Boston, such as at the Prudential Center. A comprehensive program of seismic studies and borings has been proposed; the results of these studies are expected in early spring and will enable us to make quantitative estimates of foundations costs for buildings constructed at various places in the Dorchester Bay area. In addition, the feasability of "semi-floating" buildings will be investigated.

Preliminary research confirms that water quality is at best marginal in many parts of the harbor. Studies made by Camp, Dresser and McKee indicate that a program to improve the water quality of the entire harbor to permit unlimited recreational use (e.g., swimming) would cost at least $500 million. It is not certain whether a smaller scale program to improve a particular area of the harbor (such as Dorchester Bay) would be successful. Such a program would first require a detailed survey of the pollution sources in that area. In addition an investigation of the effect of landfill, etc., on water flow is essential to prevent further fouling of the waters in or adjacent to the development site. It remains to be seen what studies are necessary, and whether these might best be carried out by MIT personnel or by a professional consultant.

While Dorchester Bay is not directly adjacent to Logan airport, it suffers from being directly beneath one of the take-off and landing paths leading to Logan. According to studies outside MIT the current noise level in Dorchester Bay does not preclude any

specific use of the site except for outdoor amphitheaters; schools, hospitals, churches, and indoor theaters or auditoriums may require special construction for noise control. Due to technological improvements, individual aircraft of the near future are expected to be no noisier than present-day aircraft. However, increased flights into and out of Logan airport will cause more planes to pass over Dorchester Bay, resulting in increased annoyance to those living or working in the area and may make noise a very serious obstacle to the development of a Fair or community. Predictions of 1975 noise levels are expected to become available this spring.

MIT is presently investigating the cost of noise insulation measures for community buildings. We are also investigating the possibility of providing some noise protection for certain outdoor recreation areas through special landscaping or structural "noise shields." At present, however, there is no indication that these efforts will succeed.

It is expected that many possible development schemes for Dorchester Bay would require landfill to increase the usable land area or to improve existing shorelines. Studies thus far have yielded unit costs for sand or clay fills obtained from marine sources. These costs vary from contractor to contractor, depending upon the type of equipment he uses and the location of his borrow areas. The projected (1972-1973) cost of hydraulic clay is $1.00 to $1.50 per cubic yard, plus $0.25 to $0.50 for a booster pump for distances

greater than about 3,000 feet. The cost of sand is expected to be $2.50 to $3.00 per cubic yard, barged from offshore areas near Plymouth. These estimates are based on a total requirement of 10 million cubic yards of fill; the unit costs are higher for smaller volumes. In addition, we are advised by the U.S. Geological Survey that the nearest "large" sources of sand are Cape Ann and Plymouth, Mass. However, while the U.S.G.S. expects these areas will contain sufficient sand for a major landfill in Dorchester Bay, the exact volume of these borrow areas is unknown.

Recent investigations indicate that dry fill material transported by rail may be quite competetive (economically) with fill dredged hydraulically or barged from marine borrow areas. Future research will be directed toward refining comparative cost data and studying new techniques for placing fill materials. In addition, studies into short-term and long-term effects of landfill on water pollution will continue, as described previously.

Transportation studies thus far have dealt almost exclusively with regional highway access to Boston, in the event the Dorchester Bay site is chosen for the Bicentennial Exposition. Rough predictions of total attendance and daily attendance have been made. These predictions appear in the appendices. Preliminary studies indicate that a successful fair might draw a sufficient number of visitors to severly tax Boston's already crowded major arteries.

Closely allied with transportation are parking, lodging, and food facilities. We are now gathering information on the current and projected capacities of these facilities located in Boston, plus information on the projected capacities of Boston's rail and air transportation services. Future research will include a comprehensive systems analysis of Boston's transportation and accomodation services to determine an optimum fair attendance. It is hoped that this optimum attendance figure might be used as a guideline for promotion and advertising, in an attempt to make the fair a pleasurable experience for the fair goers as well as the residents of Boston.

As yet MIT has not seriously approached the problems of transportation from the central city to the Dorchester Bay site and transportation within the site itself. These problems will be investigated as soon as preliminary working figures for the size and make-up of the development become established. Particular attention will be paid to the possible constraints imposed by trying to design the transportation facilities for the fair and the new community.

To date, little factual information has been gathered on utilities because of the lack of preliminary working figures for the size and number of buildings in the proposed development, both for the Fair and the new community. The gas company has expressed considerable interest in demonstrating some of their integrated utilities systems. More information will be obtained as soon as reasonably definite and detailed plans are available.

The success of a new community in Dorchester Bay will depend, in many ways, upon the people who eventually will live there. Thus the social, economic and racial composition of the new community population is extremely important; it must be a part of the design, not left to chance. Possible alternatives might range from the creation of a largely middle and upper income enclave (thereby raising the median income level in Boston) to the creation of a largely lower and moderate income community (thereby attempting to satisfy the need for housing for these groups and reinforcing the present trend in population patterns within the region).

In order to examine these alternatives, some analysis of their consequences upon the city and the region must be made. Alternative housing policies, for instance, will produce different effects upon the region's housing market. The filter process, whereby lower or moderate income families might move into housing vacated by middle income families moving into the harbor community, must be considered. Natural tendencies for populations, particularly in Boston, to group themselves into ethnically homogenous neighborhoods and for people to seek residence among their social and economic peers are important factors. Comparison of existing neighborhoods within Boston and larger population groupings, such as the entire city, the urban core and the SMSA, provide one reference point. Examination of residential issues and the construction of hypothetical models provide another.

Neighborhood models which appear to be most satisfactory are those which make provision for a broad mix of population according to socio-economic status. This meets many immediate needs for housing and, at the same time, can provide for a considerable number of middle class families, now rapidly moving out of the city. Attention, however, must be given to ownership housing, small neighborhood clusters which can preserve ethnic identify, and moderate (20-25 units per acre) density. Apartment dwellings and commercial or employment centers might be located between the smaller neighborhoods. Transportation access to the central city and to the regional transportation net must be good if middle and upper income families are to be attracted; also, the quality of municipal services must be substantially above the present level within Boston.

To achieve such a community will require innovations in creating the institutional structure that will serve the community. Participation by residents in the planning and construction of their own community may be an important aspect; neither complete dominance by the City of Boston nor complete autonomy appear to be satisfactory roles. A great deal of further research is needed to answer these crutial questions, but upon the institutional structure will depend the whole future of the community in meeting the goals and planning guidelines which are eventually established.

The contribution of the new community to the economic base of Boston has not yet been established. It is doubtful, however, that the community can provide a

satisfactory answer to the relocation needs of Boston's industry. Only those industrial and commercial activities which rely upon the central city's unskilled labor pool will be likely to locate in the bay area. Provision of employment opportunities for the less-skilled labor within the city may help meet the problems of unemployment and subemployment. Industries which train employees in skills and allow an upward mobility among workers should be encouraged.

All of these considerations provide us with possible goals for community development. These goals might be grouped into three categories. First, the new community might be viewed as a tool to meet certain objective needs of the City of Boston: housing, employment, fiscal resources, and others. Secondly, development can also be viewed as a means to stem the outward trend of the more affluent population and certain types of industrial and commercial activity toward the periphery of the region. Thirdly, the new community might serve as a prototype development, an experiment in new techniques in social and physical planning. The degree to which these goals might be achieved, and their influence upon each other, will need further examination.

The idea of a new community has been given some substance by this report; further work is required before the concept can be given sufficient definition for evaluation as a realistic proposal.

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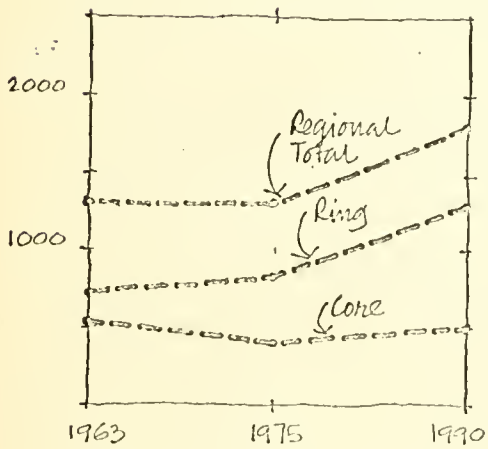
1 BOSTON AND THE METROPOLITAN REGION

Core and Ring

Economic Growth

Growth and change in population patterns and economic functions have always been a part of the metropolitan region. Since the 1940's, however, there has been a fundamental shift in the economic base of the region and an outward expansion of the region's population. These trends have produced a growing dichotomy between the cities and towns of the "urban core" (Boston, Brookline, Cambridge, Somerville, Everett, and Chelsea) and those of the "suburban ring."

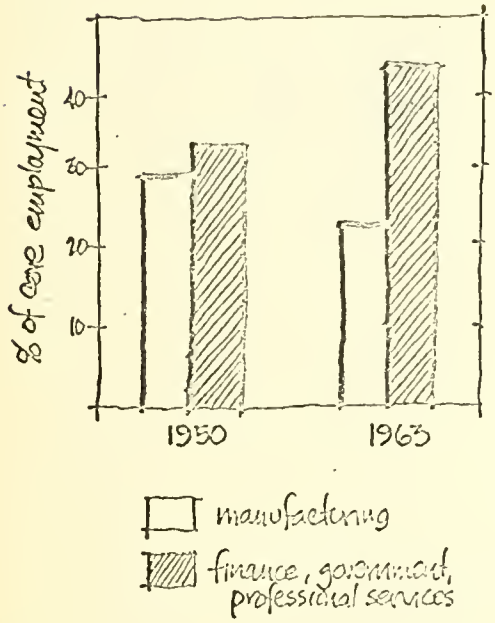
The distinction between core and ring is evident in the changing character of the metropolitan economy and population. Forecasts for the metropolitan region indicate that we are facing a period of continuing economic expansion, yet virtually all of this growth is expected to take place in the suburban ring. Between 1950 and 1963, employment in the core declined by about 80,000 jobs; projections indicate that the downward trend will continue through 1975 with total employment falling to a level of 529,400 jobs a total loss of almost 100,000 jobs in twenty-five years. In 1950 the core employment accounted for 55.3% of the region's total employment, by 1990 it will account for only 36.1%.



Projected Employment (in Thousands) in Boston Metropolitan Region

During this period there has been a shift from manufacturing employment to white-collar employment. While this shift has occurred throughout the region, the extent of the shift has been greatest in the core: between 1950 and 1963,

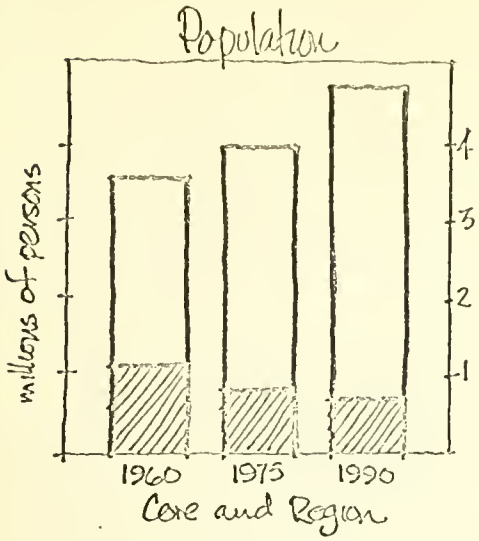
manufacturing employment declined by 33% in the core and only by 3% in the region. By 1975, manufacturing will account for only 18.4% of total employment in the Core, compared to 22.5% in 1963.



The outward movement of manufacturing and wholesale industries has left the urban core increasingly specialized in its economic functions. While fewer jobs remain in the core, expansion of white-collar employment, especially in finance, government, educational and professional services has helped to compensate for the decrease in manufacturing employment. The remaining employment base in the core, however, requires a skilled and literate work force of the type now moving away from the center. Conversely, the less skilled work force which resides in the central city is best suited for the manufacturing, sales, and service occupations that are moving to the outer edges of the region.

Population

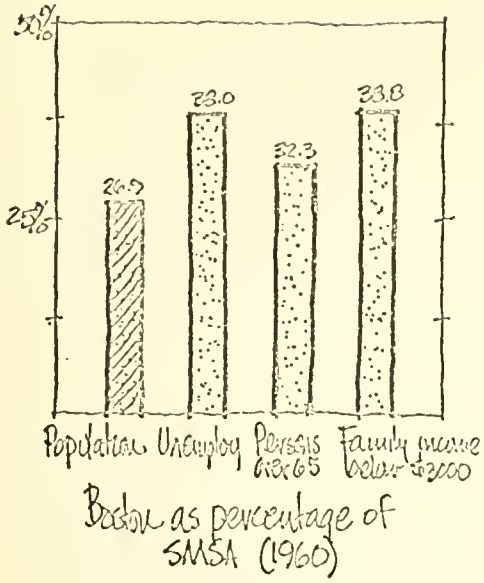
Between 1940 and 1960 the region's population grew by about 19%. This is only half the growth rate over the same period for the nation as a whole and the lowest rate of any metropolitan area in the U.S. Net out-migration from Boston itself was almost three times greater in the 1950-1960 period than it had been in the previous decade. Since 1950, the city's population has declined by 144,000 persons; a net outmigration of 191,000 whites has been partially offset by a net-inmigration of 47,000 black residents.



A growing preference for suburban residence during this time has followed the trend in rising income levels, increasingly younger ages of household heads, and the outward shift in job locations. As a result the cities of the urban core have been losing population since 1950. This decline is expected to halt within the next 20 years as Boston's population stabilizes at about 600,000 persons; by then the regional population will have grown to about 4.7 million persons.

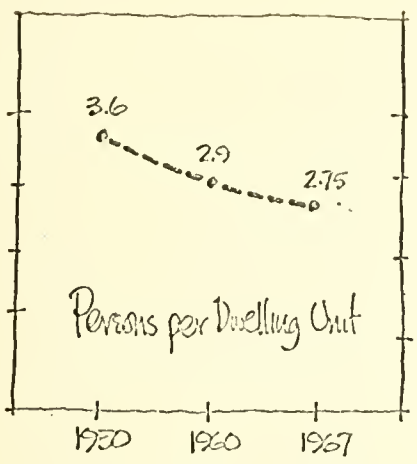
As the ring communities become more affluent, more middle class and more confident of future prosperity, the urban core is becoming relatively poorer, increasingly polarized by racial and class distinctions, and less able to cope with its mounting problems. The social and economic pressures which are being created by this widening gap are the heart of our metropolitan problems.

Although only 3% of the region's population is black, the vast majority of Negroes reside in the urban core. Thus, many of the pressures of our urban problems place an undue burden upon them. Among the Negroes, education levels are lower, housing opportunities are poorer and employment opportunities are more restricted than those of whites. The median family income of Negro Bostonians is only about two-thirds that of white Bostonians. In 1965, 90% of Boston's black population was concentrated in the South End, Roxbury, and North Dorchester neighborhoods of the city; there, too, were found the lowest quality housing, the oldest schools and the lowest level of municipal service expenditures.



The same economic pressures are felt by the poor and the elderly who are tied to the older and less desirable residential areas of the core cities. This helps to explain why median family income in Boston is only 3/4 of that in the region. People over 65 constituted 12.3% of the City of Boston's population in 1960; in the rest of the metropolitan area, the elderly represented only 10.4%. Because of jobs, social ties and a general lack of lower priced suburban housing, the poor and the elderly are unable to move outwards, and, as their older neighborhoods deteriorate, they feel increasingly besieged by the expansion of the black ghetto. Core city residents are becoming frustrated by the seeming inability of city government to cope adequately with their problems.

Housing



Average housing costs in the Boston metropolitan area, when measured against average income, are among the highest in the nation. The suppiy of new dwelling units constructed in the region has failed to keep pace with growing demand; between 1960 and 1966, an average of 10,450 dwelling units were added each year, representing an annual increase of only 1% in the regional housing stock. Although this increase matches the regional population growth, it makes no allowance for the trend towards fewer persons per dwelling unit. As a consequence housing prices have gone higher and higher.

The tight market has had consequences other than rising prices. Due to an extended economic life caused by the tight market, the number of sub-standard units in the metropolitan area has not dropped appreciably in recent years. One out of every five of the region's 840,000 housing units was judged to be "inadequate" in 1965; they failed to meet the standards for quality and quantity of living space considered minimal by our society.

Within the core cities, housing choices are even more limited and prices higher than in the region as a whole. An average of 24% of gross income is spent on shelter in Boston; recent Bureau of Labor Statistics data show Boston as one of the three most expensive U.S. regions, requiring yearly income of $10,000 for a family of four to maintain a "moderate" standard of living.

There are few vacancies to be found in single-family residences or among the larger apartment units in the city. For lower income residents, especially those with large families, housing of any quality is becoming increasingly difficult to find. Boston's renewal and highway programs have demolished twice as much housing since 1960 as has been built, yet Boston, with over 50,000 substandard units, still contains almost half of the substandard housing in the metropolitan area. Those units which have been built in the past eight years are largely middle and upper income apartments.

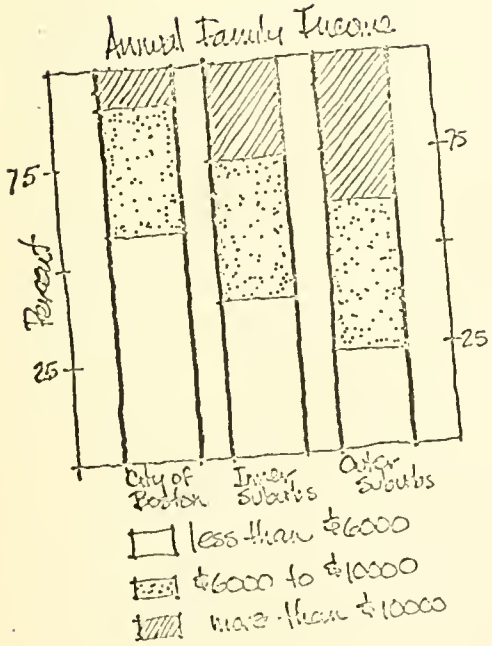
Given projected population patterns, even the most optimistic assessment of improvement in the housing stock under existing and projected programs indicates that there will be a need for about 20,000 new housing units in the urban core by 1975. While this housing requirement will be predominantly in the lower to moderate income range, there will still be a considerable demand for middle and upper income rental housing.

Fiscal Problems

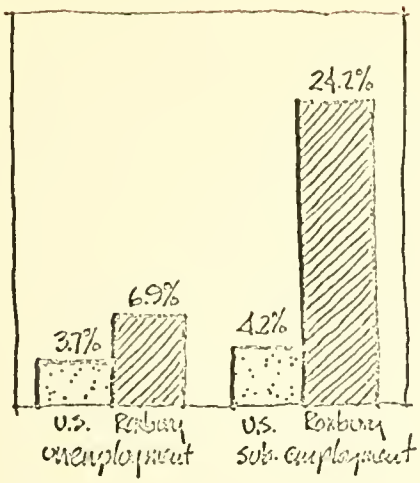
Because the older core cities are not participating in the overall metropolitan growth of population and industry, they are experiencing a relative stagnation in the growth of municipal revenue sources. The City of Boston depends heavily upon revenues from property taxes, yet Boston's taxable real property base has not expanded in 20 years and more than half of Boston's real property is tax exempt. The prospects for widening the property tax base are slim in the urban core because of the

scarcity of land for development. Of the estimated 876,000 acres of land in the regional area, vacant and developable in 1963, only 1.1% was located in the area inside of Route 128, and only a small share of this was in the City of Boston.

Lack of adequate tax revenues has made it impossible for the core cities to meet the demands for higher quality education, increased welfare, better recreational facilities and improved city maintenance. This fiscal strain has produced a rising property tax rate and a decline in the quality of marginal but important city services. For the most part, the highest tax rates in the metropolitan region are to be found in the core communities, where family incomes are low and people can least afford to pay.



The more affluent city dwellers, finding that suburban residential locations offer a higher quality of municipal services, often leave the urban core. The population remaining in the core is considerably less well educated and less affluent and contributes less towards tax revenues.



A 1966 survey showed that the unemployment rate for the South End and Roxbury sections of Boston was twice that of the metropolitan regional average. Sub-employment, those persons not employed full-time or earning below $3000 per year, is an even more serious problem. Combined, these indicies reflect a hard core of poverty which constitutes a drain on the well-being of the area's population. The continual loss of low-skilled employment opportunities in the urban core has been one cause of the growing unemployment.

Transportation

People have been moving out of the urban core more quickly than jobs. The decline in the resident labor force within the core cities has therefore resulted in an increase of daily commuters into the core. Data from the 1960 census showed that 91,700 core residents worked outside the core, while 192,700 suburbanites commuted into the core to work. Forcasts show this trend continuing; between 1960 and 1975 employment in the core will fall by 28% while the resident labor force falls by more than 30%. By then commuters will make up more than 40% of core employment. The severe congestion already evident within the core, caused by both truck and automobile traffic, reduces the efficiency of the core in carrying out its normal functions. This congestion is also a major factor in preventing new, transportation-dependent industries from locating within the urban core.

Air transportation is becoming increasingly vital to the economic life of the region. Logan Airport is expected to reach saturation by 1975 when the annual number of airline operations climbs to 574 thousand, a 200% increase over the 180 thousand operations in 1967. A second airport will be required to handle air traffic after that date.

Summary

The Boston region, like other urban areas across the nation, is experiencing a wide variety of problems as it adjusts to 20th century technology, ranging from a changing social mix to alterations in its economy. A major product of these changes has been an outward shift of people, commerce, and industry, leaving behind in the core city an unhappy combination of physical decay, social discontent, and economic frustration. The end result is a growing dichotomy between the older core cities and the suburbs, with the former containing increasing proportions of low-income people, particularly of racial minorities.

Boston has shown unusual vigor, among core cities, in attempting to deal with its problems, and has made considerable progress in restoring its economic health during the past decade. The city is unquestionably a healthier, more vital and interesting organism than it was; it is for many of its residents a better place to live. Great problems remain, however, and many of these cannot be solved by the city itself; they are metropolitan in scope, and Boston is but a small portion of the total metropolis. Ultimately, new ways must be devised, through the creation of new metropolitan institutions, through active state intervention, and through other devices, to tackle these problems in a comprehensive manner.

In tbe meantime, Boston must look to its own resources in meeting its problems. The open space represented by portions of the harbor may be particularly valuable for its development offers the city an opportunity to deal with some of these problems in a partial but still significant manner. It is our premise that by making the urban core more attractive, a portion of the urban suburban imbalance may be rectified and the economic and social health of the entire region improved.

2 THE PROBLEMS OF THE CITY OF BOSTON

The types of problems which face Boston are common to most large cities: a lack of adequate housing, high rates of unemployment, and poverty, growing tensions between racial and class groupings, traffic congestion, a rising strain on fiscal resources, a relative decline in the quality of public services, and a host of others. Many of these problems, as we have seen, are symptoms of larger changes in the character of the urban area. The outward flight of economic activity and the more affluent members of our population have drained Boston of much of its attractiveness. The city which remains is considerably older and poorer than its surrounding suburban ring.

The character of harbor development might take many forms, but it should seek to meet the problems of the city. The process of identifying an optimal use of this space should begin with a definition of Boston's needs and the establishment of some priority among these needs. This process should lead to a clarification of development goals. At the same time, a determination of the constraints imposed by the site must be made. The resolution of these two forces -- the goals on one hand and the constraints on the other -- should assist in establishing the nature of any future development.

Our investigation of Boston's problems has, for convenience, been grouped into seven categories. Although some overlap exists, this list has provided a useful starting point.

1. Population
2. Housing
3. Economic Base
4. Employment
5. Social
6. Political
7. Environment

Population

A great deal of data is available on this subject and, until more precise requirements for it have been established, no single report will be compiled. References and source material includes the U.S. Bureau of the Census, The Community Research Project sponsered by United Community Services, (UCS) The Metropolitan Area Planning Council, (MAPC) and the Action for Boston Community Development (ABCD). Some of the general characteristics of the present population and trends of population change have been summarized in Chapter I.

HOUSING

Additions to the Housing Stock

The number of dwelling units in the city, now about 236,650, has remained fairly constant since 1960; In spite of an increasing construction rate, demolition for urban renewal and highway construction has offset gains. Between 1960 and 1967, 10,035 new units were built and 12,939 were demolished for a net loss of 2,900 units during that period. (1968 FHA data)

The decrease in city population, from 801,400 in 1950 to 650,000 in 1967, has been accompanied by a decrease in the average number of persons per dwelling unit, from 3.60 to 2.75 during the same period. Thus the number of housing units has remained fairly constant, rising from 222,079 in 1950 to 235,900 in 1967. Although Boston's population is expected to continue to decline, falling to 606,300 by 1975 according to an MAPC projection, an increase of 20,000 households is projected for that date, requiring additions to the existing housing stock.

Upgrading the Housing Stock

An estimated 40,000 dwelling units within the city are now substandard. By 1975, 25,000 of these units are expected to remain and an additional 10,000 -- 15,000 will have become either obsolete, due to rising housing standards, or substandard, due to the continual aging of Boston's already ancient housing stock.

Vacancy rates

Based upon a 1966 Postal Survey, the FHA estimated vacancy rates throughout the city of Boston. (Boston Housing Market, 1966.) The overall rate for the city, the percentage of vacant dwelling units among all dwellings, was calculated to be 2.8%. This was evenly distributed among residences, 2.7%, and apartments, 2.9%. The most remarkable deviance from this pattern occured in Roxbury, where 12.5% of the residences were vancant. Urban renewal activities may have accounted for this.

Wider housing choices

In 1967, the vacancy rate (the % of all units which are available but not occupied) for ownership units in Boston was 0.9%, an extremely low figure indicating a very tight housing market. The vacancy rate for standard rental units was also low, especially among apartments for large families. Virtually no ownership housing for lower, moderate or middle income families has been constructed in the city in recent years. Families seeking better quality housing are usually forced to look beyond the city to the suburbs in order to satisfy their needs.

Discrimination

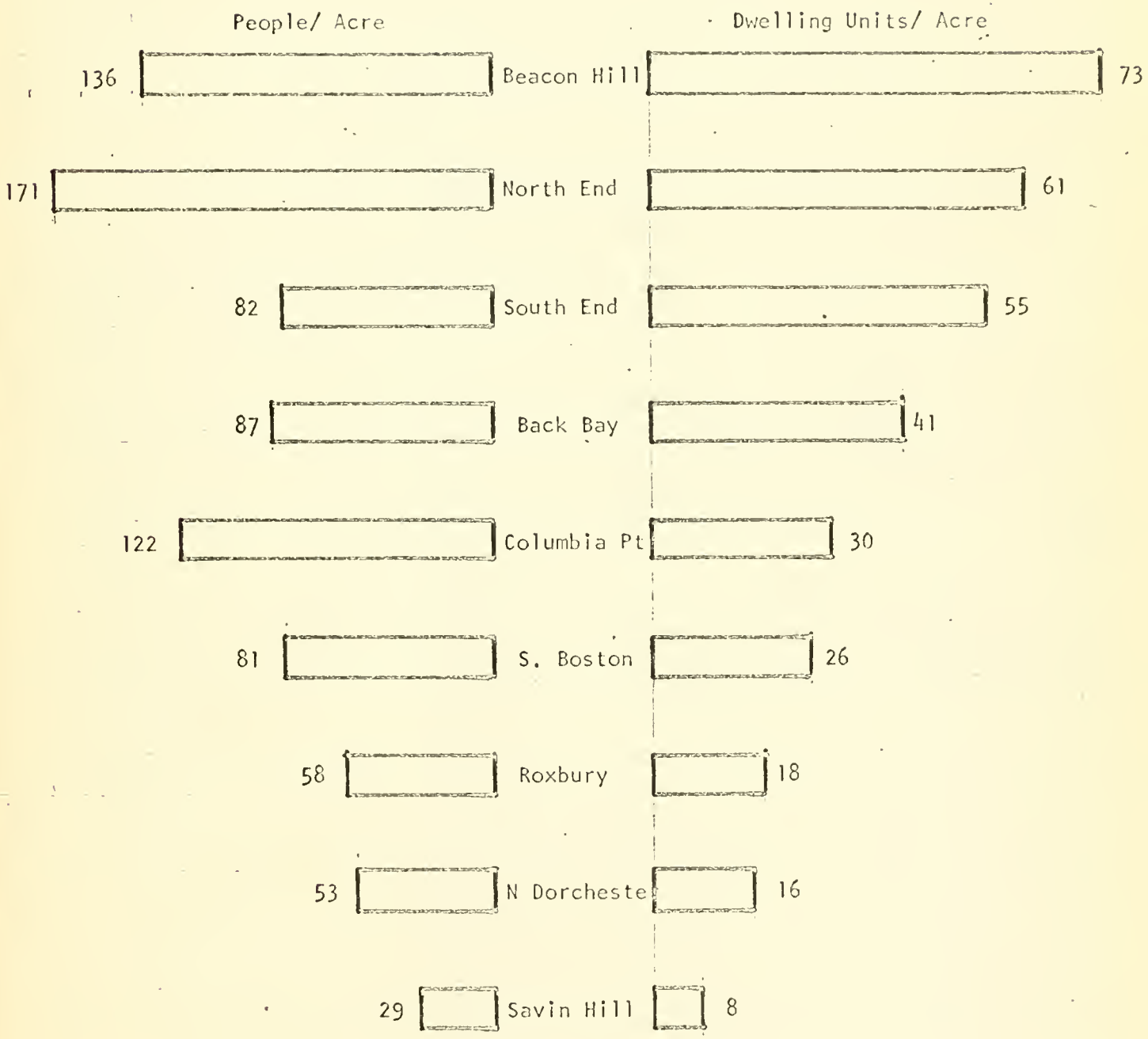
Because racial discrimination largely limits their housing choices to the ghetto area, Negro families are often forced to accept substandard housing. In 1966, 40% to 45% of all black households in Boston were in substandard housing. (CRP data) In addition, this lack of metropolitan-wide housing choices gives rise to an ever-expanding ghetto and the resultant perpetual conflict with established communities along the ghetto borders.

Residential Densities

A graph of comparative neighborhood densities appears in Figure 1. The significance of these densities can be properly evaluated only if the type of dwelling units and the layout of the neighborhood are also considered. North End, for example, has almost no high-rise buildings but also has little open space, extremely narrow streets and small dwellings. Back Bay, on the other hand, has larger buildings but considerably more open space, very wide streets and, often spacious apartments.

Figure 1

COMPARATIVE NEIGHBORHOOD DENSITIES
(1960 Census Data)



Ownership

The overwhelming preference for homeownership is demonstrated in the following statistics from the Survey Research Center, (1963 and 1965; Institute for Social Research, University of Michigan). Each year about 750 households were sampled from 32 metropolitan areas (excluding New York City but including 11 of the remaining 12 largest areas).

Each sample was about 750 households. Sample was taken from 32 metropolitan areas (excluding New York City) and included 11 of the remaining 12 largest areas.

The current actual distribution of families in single family homes moves upward in a straight line from 41% of families with incomes under $2000 to 90% with incomes over $15,000. The average of the total sample is 69% of families live in single family homes.

Each survey found that of the roughly one third of their sample that lived in multifamily housing 67% of that third would prefer (no mention of cost) to live in a single family house.

This desire to live in single family house is strongest among those currently living in 2, 3 or 4 family houses or row houses-where 72% said they's rather live in a single family. Only 46% of those currently in apartments preferred to live in single family houses. Stated preference for single family living is related to current income: 52% of families with income under $2000 and 94% of families with income over $15,000 would prefer to live in single family houses.

Figure 1

COMPARATIVE NEIGHBORHOOD DENSITIES
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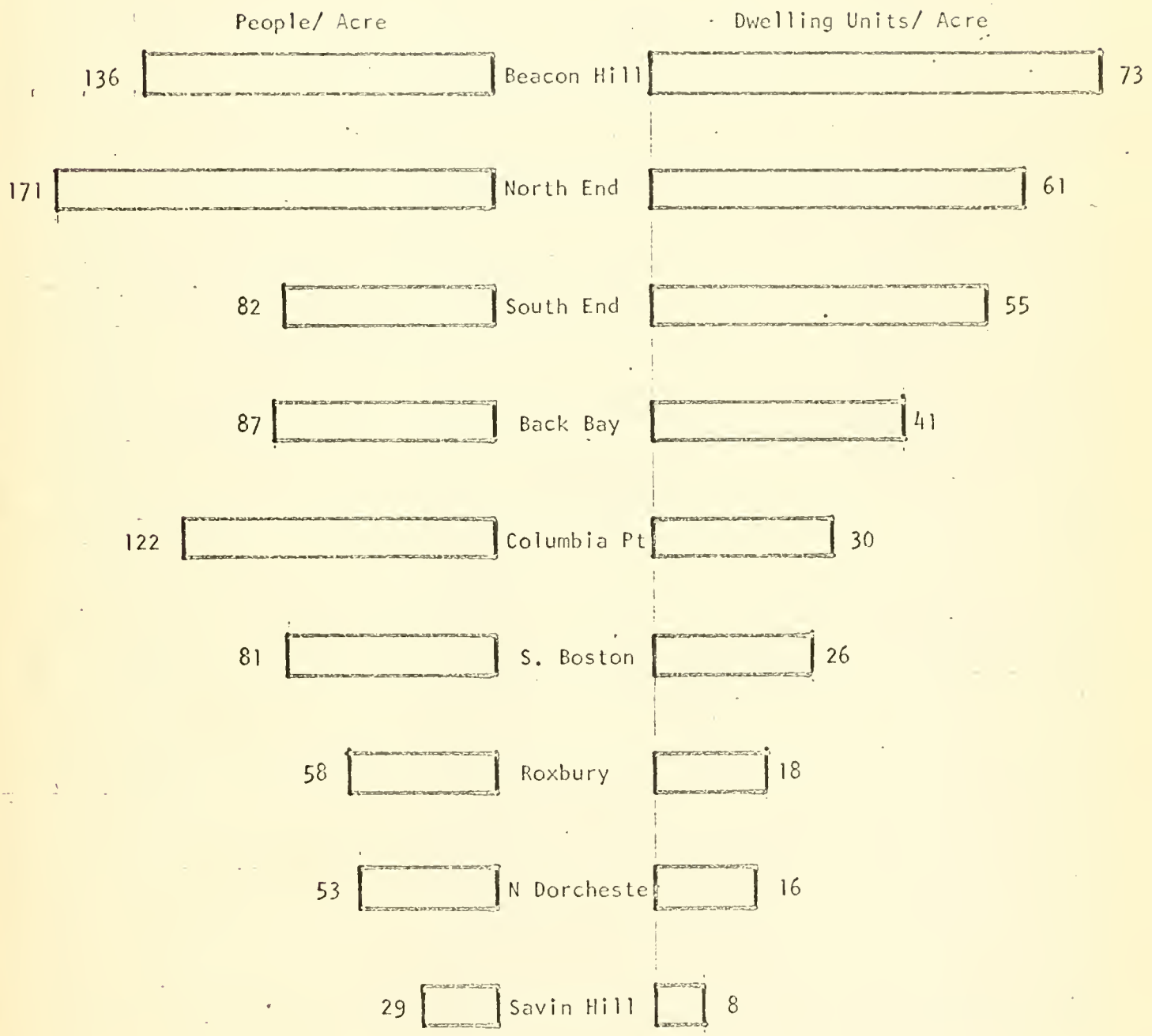

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Between surveys, the researchers began to wonder if it was ownership rather than single family houses as such that appealed to people. In each survey 85% of the sample said they would prefer to live in a single family home. In the second survey that 85% was asked whether they would rather own or rent given their family situation. 76% (of that 85% who preferred the single family) said they would rather own. Of that 76% only 2% said they would rather own an apartment than a single family home.

Housing Submarkets

The housing market of the City of Boston consists of a series of submarkets. Each submarket can be differentiated as a collection of housing units which are significantly more competitive with each other than with other units in the total housing market. Submarkets are defined according to each of the variables which affect consumer choice; Boston's submarkets are defined in several dimensions: by tenure, by cost, by structure type, and by location.

The primary variable in this study has been cost, which can be represented in terms of actual costs, shelter costs to consumer, or consumer income. Submarkets based on cost usually are broken down in terms of household income.

Submarket	Household Income
Lower income	0 - $ 4,000
Moderate Income	4,000 - 7,000
Low middle income	2,000 - 10,000
Upper middle income	10,000 - 14,000
Upper income	14,000 +

In the remainder of this section the existing stock in each of these income-defined submarkets will be discussed. Whenever data is available the characteristic of the stock along the other dimensions will also be

Lower Income Housing

The upper limit for this submarket, $4,000, was selected as the approximate lower limit for access to new housing, other than public housing. The $4,000 figure is about the minimum for housing built under Federal mortgage interest subsidy programs such as the old 221(d)3 and the new Sections 235 and 236 which are discussed below.

The lower income housing stock in Boston consists of three general types, publicly owned housing, publicly subsidized units and old, often substandard housing.

Public Housing

Boston has 14,747 units of public housing owned by the Boston Housing Authority (BHA). Construction of 75% of these units has been financed by the Federal government and the remainder by the Commonwealth of Massachusetts. Tenants must pay rents sufficient to cover costs of operating, maintaining and managing the buildings. Current levels of these costs force the BHA to charge an average rent of $68 per month; rents for individual housholds are both lower and higher than this average, depending upon household income and number of persons/family.

The Federal Housing Assistance Administration (HAA) specifies maximum family income limits for units it finances. The BHA must then control its tenants' list by income beneath this ceiling so as to keep the average rent high enough to meet expenses. As a result of these cost constraints, there are also practical minimum incomes for entrance to public housing. Vacancies in public housing occur at a rate of about 1,800 per year; the waiting list normally includes about 3,000 to 4,000 active applications and an estimated 2,000 new applications are filed each year.

Housing subsidy

A second kind of housing available to lower income families in Boston are those units publicly subsidized through the public housing leasing program or the rent supplement program. The BHA, through Federal subsidies, can lease housing on the private market which is then made available to lower income families. Presently 1,635 units are leased, although only 940 are currently occupied. The BHA has Federal authorization for 1,365 additional units. Most of the leased units, about 75%, are in recently built 221(d)3 projects; the remaining units are in privately owned buildings. Income limits, rents and tenant selection policies are similar to those for BHA owned units.

The rent supplement program is also administered by the BHA and is similar to the leasing program. The chief difference is the source of Federal funds, which come from the Federal Housing Administration (FHA) rather than the HAA. The eighty-four units of the Marksdale II, a 221(d)3 project in Washington Park, are entirely rent-supplemented. Several South End apartments, rehabilitated under 221(d)3 by South End Community Development, Inc., are also being subsidized through this program.

Old Housing

By far the largest component of the low income housing stock in Boston is the supply of old privately-owned housing. Much of Boston's housing stock is more than 40 years old and is rapidly aging. (See, for example; Frieden, Bernard; The Future of Old Neighborhoo Cambridge; MIT Press, 1967.) The construction debt on this housing has long been paid off; thus it is possible for buildings to remain in service, their only expenses being their taxes, operating and

maintenance costs. Many elderly households within the city have been able to retain ownership of their single-family homes or "three-deckers", despite low incomes from pensions or low-skilled jobs. Many of the city's rental units are in neighborhoods in which the only market demand comes from lower income families. Owners meet this limited demand with low rents based on low levels of maintenance and operation.

This low income supply is threatened by reduction from several directions. In the South End, for instance, several hundred lower income units are being bought up and rehabilitated for middle income occupancy each year. Structures continually drop out of the supply as they deteriorate beyond habitable condition and are abandoned. Many of these buildings, plus substandard, but serviceable units, are removed each year by public action. Boston's urban renewal programs have demolished about 9,500 substandard housing units within the Roxbury-North Dorchester area since 1960. About 4,900 new units had been constructed or were under construction in 1967, resulting in a net loss of approximately 6,400 units. (FHA data) Since few of the replacement dwellings can be reoccupied by lower income families, a substantial loss of housing for this income group has resulted.

Virtually no new units are being added to the private market low income supply of housing. The high costs of construction, property taxes, heat and other operating items, assures that any new housing offered to lower income families must be subsidized in some manner.

TABLE I

221(d)3 HOUSING IN BOSTON

Location & Date		No. of Units	Monthly Rent Range
Marksdale I	(1964)	82	$85 - 105
Charlame I	(1964)	92	88 - 109
Marksdale II	(1965)	84	88 - 108
Academy I	(1965)	202	75 - 147
Academy II	(1967)	316	75 - 110
Westminster	(1967)	70	95 - 110
Charlame II	(1967)	38	---
Castle Square	(1967)	500	88 - 117
Warren Gardens	(1968)	228	---
South Cove	(1969)	224	85 - 125
TOTAL UNITS		1,836	

Moderate Income Housing

Moderate income defined above as the $4,000 to $7,000 range, is similar to the lower income range in that the only new housing available to this group must be publicly owned or publicly subsidized.

This range includes the upper portion of the public housing income scale, including leased housing and rent supplements. In addition, it includes most of the range of incomes eligible for housing built under subsidized interest programs such as 221(d)3, 235 and 236.

These programs account for almost all of the new housing being added to the stock in this submarket. In the Boston metropolitan area, several thousand 221(d)3 units have been produced in the past few years; in Boston 1836 units have been constructed at a cost of about $33 million since 1964. (See Table I.) Most of these are garden apartments units built at medium (19-27 units/acre) densities. Most 221(d)3 projects are rental; however one of the most recent, Academy II in Washington Park, is operating on a cooperative ownership basis.

A number of moderate income units are also being produced by subsidized rehibilitation of former lower income units. The current 2,000-unit Boston Renewal Program in Roxbury is the most significant effort of this kind; on the order of 100 units have been rehabilitated in the South End using 221(d)3 financing.

A portion of any additional family units built by the BHA can be counted as additions to the moderate income stock. For instance, part of the 400 units planned for the South End would accommodate families in this income range.

Shelter expenditures for families in this group run from perhaps $80.00 per month to $150.00 per month. This covers taxes, operating costs and a fair amount of maintenance. With adequate maintenance much of this older stock can be kept in standard condition for an indefinite period of time.

The bulk of moderate income housing, as with lower income housing, is found in the standing stock of privately owned structures. Most of these are older structures, generally in the older neighborhoods of the city.

This stock of privately-owned moderate income housing is fed from below by private rehabilitation and from above by the "filtering down" of better housing. It is also subject to loss as a result of public actions, such as urban renewal and highway construction.

Market Turnover

A BHA estimate, based upon the 1965 Housing Census data, revealed an annual housing turnover in Boston of the following magnitude:

Public housing	---	1,900 units/year
Private lower income	--	15,400
Moderate income rental	-	18,500

Lower Middle Income Housing

This supply in this income range is similar to that for the moderate income group. A large portion of the 221(d)3 units are occupied by families in this range. Most families in this range are housed by the private market in used homes and older apartment buildings. No new construction by the private market is within the reach of economic access of this garage.

TABLE II

RECENT UPPER INCOME HOUSING IN BOSTON - (JULY, 1967)

Location	Development Name	No. of Units
Back Bay	Prudential	1,125
	176-180 Beacon St.	130
Parker Hill-Fenway	Kenmore Sq. Apts.	151
	Back Bay Towers (Whitney St.)	146
	Charles Bank (Whitney St.)	276
Jamaica Plain	Jamaicaway Terrace Apts.	282
CBD	Tremont on the Common	376
South Boston	Pier (2)	1,200
West End	Charles River Park	1,413
West Roxbury	Blueledge Road	274
	Highcrest Road	182
	Byron Road	197
	Brooklawn Park	429
	Grove Street	108
Brighton	Commonwealth Court	127
	1935 Commonwealth Ave.	170
	Lake Shore Rd.	352
	Newton Street	390
Dorchester	875 Morton Street	208
	Bismark Street	240
Hyde Park	Siena Road	217
Roslindale	575 American Legion Highway	126
	TOTAL	8,119

Upper Middle and Upper Income Housing

The $10,000 yearly income level represents a fairly distinct breaking point. Above it, no direct public subsidies are utilized. A family needs this income or more to be financially able to buy a new house or enjoy new apartment construction within the City of Boston. Table II lists the new housing constructed for this submarket within the past few years.

Summary

The housing problem in Boston has two aspects: the lack of adequate housing choices for lower to middle income groups and the lack of new ownership housing for middle to upper income groups. Wider housing choices would permit some reduction in the current stock of substandard units, and might help to lower the rental scale within the market; it is often true that families earning below $4,000 are paying at least 25% of their income for housing of any quality.

New ownership housing within the city would provide an alternative to suburban housing for those families now residing in Boston but who are considering a move. Since few homes within the city can now compete with suburban residences in terms of quality and price, this choice is often very one-sided. The continual supply, by the private market, of units to the upper income rental markets can be expected to satisfy the growing demand for these units.

ECONOMIC BASE

Identifying the objective economic needs of the City of Boston with any precision is a very difficult task. Pertinent statistical information dealing with the city as a separate entity from the metropolitan area or region is sometimes lacking. Much of the information now available is already outdated and information on future needs resulting from dislocation cannot be predicted for the period between 1976 and 1980. However, available information provides a basis for identifying the more salient features of the Boston economy and can serve as a basis for informed speculation on its future trends and needs.

Basic Economic Trends

One aid in evaluating economic needs is to examine the characteristics of the Boston economy which now tend to attract businesses. The Metropolitan Area Planning Council's Economic Base and Population Study (Vol. I) divided regional business into four groups; "transportation-sensitive," "labor-sensitive," "external-economies," and "inertia-unclassified." The study reported that "both regionally and nationally, the inertia-unclassified group of industries had the highest national market manufacturing output." In this category are industries whose locational advantage no longer exists, whose links with other industries in the area are important to their operation and those industries which could not be more adequately classified due to lack of information.

In Eastern Massachusetts the second largest group of industries was "labor-sensitive" while nationally the second largest group was "transport-sensitive." In these two trends lie the strength of the regional economy. Boston and the surrounding area has the industrial disadvantage of high industrial fuel and electrical power costs, an absence of raw materials, poor access to the larger consumer markets and a high cost of living. As Robert W. Eisenmenger observed, Boston has a "labor-intensive" economy (Economic Development in the Boston Area, "The History and Structure of the Boston Economy," Joint Center for Urban Studies, 1965.) In other words, Boston markets products which require intensive use of skilled labor -- a more or less direct result of Boston's high concentration of educational and research institutions and skilled and professional labor. The concentration of research and development enterprises in Boston -- the most salient feature in this area of the "inertia-unclassified" group -- is a positive advantage to these businesses. The other major advantage is the concentration of skilled workers. Roger E. Bolton noted:

> The greatest single explanation for Boston's research advantage seems to be its educational institutions. The wealth of teaching and research talent in these institutions makes private industry and government research easier and cheaper here. These advantages offset to some degree the area's handicaps in the usual mass production manufacturing industries. (Economic Development in the Boston Area, "National Defense Spending in the Boston Area," Joint Center for Urban Studies, 1965).

Relocation Needs

One basic economic need is the relocation of businesses resulting from the public land acquisition for urban renewal projects and highway construction. According to information compiled in 1966 by the Boston Redevelopment Authority, 1,820 firms will be displaced between 1966 and 1972 (an approximate rate of 280 dislocations per year although the actual figure is susceptible to considerable annual fluctuation). The breakdown of types of business to be relocated is outlined in Table I. Since many of the projects causing these relocations are behind schedule, the relocations outlined in this table actually will extend beyond 1972.

TABLE I *

1966-1972 RELOCATIONS BASED ON
1966 INFORMATION

TYPE OF BUSINESS	no. of firms to be relocated	% of relocated firms	no. of employees	% of relocated employees	no. of square feet presently occupied	% of relocated sq. footage	square feet per worker
RETAIL	684	37.7	2566	18.2	1,582,930	18.7	620
SERVICE	448	24.6	1976	14	1,517,980	18	770
WHOLESALE	286	15.7	2586	18.3	2,136,100	24.5	830
MANUFACTURING	268	14.7	6006	42.5	2,089,700	24.7	350
TRUCKING AND WAREHOUSING	72	4.0	514	3.6	924,460	10.9	1800
CONTRACT CONSTRUCTION	62	3.4	483	3.4	196,970	2.3	410
TOTAL	1820	100.1	14131	100.0	8,448,140	100.1	---

* Information extracted from Industrial and Commercial Business Relocation in The City of Boston, Boston Redevelopment Authority, August, 1966.

This information suggests several trends. Most of the firms are small in both square footage and employment. 75% of the firms being relocated employ less than seven employees. Over half of these employ less than three employees. Only nine firms employ over 100 employees while another 35 firms employ 50 to 100 employees.

The square-footage requirement is a major problem for the larger firms. While Boston has a substantial inventory of unutilized space, this space is divided into relatively small parcels. Thus, the firms utilizing relatively little space, all other factors being equal, should be able to relocate in the city of Boston. All other factors are generally not equal though, particularly in the case of smaller enterprises.

Relocation of Small Businesses

Past experience shows that roughly 20% of the dislocated businesses liquidate. The rate of liquidation is greatest among the smaller firms -- many of them retail establishments. Past studies have identified three basic reasons for liquidation resulting from dislocation among small businesses:

(1) Many of these businesses are centralized and small and therefore cannot absorb the costs of relocation (because of the time lapse between vacating the existing location and reopening at a new location), the costs of remodeling and the increased costs of the new physical plant.

(2) The relocated business is unable to establish a clientele during the critical first two years. This is particularly common among stores which have catered to local (neighborhood) business.

(3) The proprietor may find it personally desirable to liquidate rather than relocate. Frequently, an elderly proprietor or the proprietor of a marginal business finds the demand to relocate a convenient juncture at which to terminate the business. (U.S. Advisory Commission on Inter-governmental Relations, Relocation: Unequal Treatment of People and Businesses Displaced by Governments, Washington, D. C., 1965.)

Relocation of Large Businesses

The relocation of larger firms presents different problems. These firms encounter greatest difficulty in finding a new location within the city which is large enough to suit their needs. Those firms which rely on more skilled labor find it convenient to relocate in the suburbs where there is available land and a larger pool of skilled labor. The larger firms that rely on the unskilled labor pool of the inner city are not as free to move outside of the city. Four recent projects in Boston causing displacement of businesses (Central Artery, Castle Square, Government Center and Washington Park) resulted in approximately 8% of the dislocated firms relocating outside of Boston.

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1/24

EMPLOYMENT

General

As stated earlier, Boston is increasingly dependent on its skilled labor force. This trend is particularly apparent when employment patterns are compared with the rest of the country but is also apparent when compared with the rest of the Commonwealth. (See Table II)

Despite the fact that this table includes the entire SMSA, some of the more significant trends stand out: The greater significance of manufacturing in the rest of the state as compared with Boston; and the greater significance in the Boston SMSA of the retail and wholesale trade, finance, insurance and real estate, business and professional services, private educational services, and public administration.

In terms of occupational groupings, the trend over time toward a greater skill level in the labor force is similarly apparent, (See Table II).

TABLE III *

Major Occupational Group	Change: 1950 to 1960 Increase	Decrease	Percent Change
Professional, technical and kindred workers	39,300		35.6
Clerical and kindred workers	27,300		16.7
Operatives and kindred workers		7,700	-4.3
Laborers, except farm and mine		8,800	-20.3

* Source: Manpower Skills Survey, Boston SMSA, Boston College, 1964, p. 14.

TABLE II *

INDUSTRY GROUP OF EMPLOYED PERSONS, 1960°.
BOSTON SMSA AND REMAINDER OF STATE

INDUSTRY	BOSTON		REMAINDER OF STATE	
Totals	1,023,725	100.0	976,587	100.0
Agriculture	5,218	.5	16,900	1.7
Forestry and fisheries	1,193	*	2,836	.3
Mining	597	*	616	.1
Construction	51,042	5.0	48,781	5.0
Manufacturing	294,434	28.8	414,834	42.5
Railroad and railway express service	6,971	.7	5,111	.5
Trucking service and warehousing	12,277	1.2	11,077	1.1
Other transportation	19,064	1.9	6,802	.7
Communications	16,929	1.7	11,180	1.1
Utilities and sanitary service	13,132	1.3 / 6.0	12,921	1.3
Wholesale trade	42,229	4.1	23,682	2.4
Food and dairy products stores	29,327	2.9	26,310	2.7
Eating and drinking places	27,386	2.7	23,350	2.4
Other retail trade	91,984	9.0 / 10.7	82,252	8.4
Finance, insurance and real estate	62,810	6.1	33,497	3.5
Business services	17,945	1.8	7,749	.8
Repair services	10,902	1.1	11,128	1.1
Private households	17,289	1.7	14,674	1.5
Other personal services	29,569	2.9	23,270	2.4
Entertainment and recreation services	6,871	.7 / 8.2	5,041	.5
Hospitals	36,617	3.6	31,684	3.2
Educational services: Government	28,718	2.8	31,823	3.3
Private	35,371	3.5 (12.3)	17,529	1.8
Welfare, religious and nonprofit membership organizations	13,542	1.3 (4.9)	11,166	1.1
Other professional and related services	40,279	3.9	25,200	2.6
Public administration	56,669	5.5	38,325	3.9
Industry not reported	55,361	5.4	38,849	4.0

* Less than .05.

° Includes self-employed.

Calculated from: Department of Commerce, Bureau of The Census, U. S. Census of Population: 1960. General Social and Economic Characteristics, Massachusetts (Washington: U. S. Government Printing Office), Series PC. (1), 23D, pp. 143, 201.

*Source: Manpower Skills Survey, Boston SMSA, Boston College, 1964, p. 7.

The great increase in the number of professional, technical, and clerical workers shown in Table III, demonstrates the dramatic shift towards a more highly skilled labor force required by the expanding research, development and electronics industry in the Boston area.

This trend is also manifested in manufacturing employment trends where durable-goods production, which generally relies on more highly skilled workers and provides a higher wage rate, is expanding its labor force, while nondurable-goods manufacturing is experiencing a contraction in its demand for labor. (See Table IV).

TABLE IV *
MANUFACTURING EMPLOYMENT
BY INDUSTRIES
BOSTON SMSA
JANUARY, 1967

	EMPLOYMENT (in 000's)	AMOUNT OF CHANGES JAN. 1966-JAN. 1967 (in 000's)
Manufacturing Total	299.4	+ 9.2
Durable Goods Total	168.6	+12.8
Primary Metals	4.7	+ 0.3
Fabricated Metals	18.6	+ 1.4
Machinery (Ex. Elec.)	36.3	+ 2.1
Electrical Machinery	54.2[2]	+ 3.6
Transportation Equipment	23.6	+ 2.8
Instruments	19.7	+ 2.4
Other Durable Goods	11.5	+ 0.2
Nondurable Goods Total	130.8	- 3.6
Food	24.6	- 1.1
Textiles	5.8	- 0.5
Apparel	18.0	- 0.4
Paper	10.5	+ 0.1
Printing	24.1	+ 0.1
Chemicals	9.0	- 0.1
Rubber	15.0	+ 0.1
Leather	16.4[1]	- 2.2
Other Nondurable Goods	7.4	+ 0.4

[1] Strike
[2] Strike Over

*Source: "Employment Newsletter", February, 1967. Published by the Massachusetts Department of Labor and Industries.

Reproduced Here From: "The Boston Metropolitan Labor Force 1966-1967" (p.4)

It is not surprising then that the Metropolitan Area Planning Council found "Almost every new job created in the past decade required professional, technical or clerical skills."

Unemployment and Sub-Employment

Boston has one of the lowest unemployment rates in the country. In 1966 the national unemployment figure was 3.7% of the work force as compared to 3.4% in Boston. However, as one might assume, this figure obscures the more severe employment problems in Boston's poorest neighborhoods.

A study (conducted by the Massachusetts Division of Employment Security and the U.S. Department of Labor in November, 1966) of the 14 poorest census tracts from Boston's 1960 census revealed an unemployment level of 6.8%, and even this unemployment figure fails to demonstrate the depth of Boston's slum-employment problems. Not appearing in the unemployment figure is the 8.5% of those having full-time jobs who earn less than $60 per week, thus putting their annual income below the conservative $3000 poverty figure. The figure also excludes the 18% of these Boston slum residents who work only part-time. Unemployment also excludes those people who would be working under normal circumstances, but are not working and are not looking for work. In the slum areas of Boston 19.7% of the men between 20 and 64 years of age were in this category. Although about 24.2% of the slum area residents are included in these "sub-employment" categories -- "almost one out of every four residents has a serious employment problem."

The study revealed that 70% of the unemployed were non-white; 60.5% of the unemployed were in the 20-64 age group; and 23.1% were in the 16-19 age group in the areas studied. The population in most of these areas was predominately Negro. It should be noted that while the employment problems of non-whites are highly concentrated in specific areas, there are some areas of Boston, particularly in the North End, Charlestown and East Boston, which are predominately white and which fell into the lowest quartile in income, educational attainment and highest male unemployment. (Income, Education and Unemployment in Neighborhoods, United States Department of Labor, January, 1963).

The 1966 survey revealed that a high percentage of unemployed individuals attributed their inability to obtain jobs to a lack of education or skills (32.2%.) Another 11.9% cited a lack of available jobs as being the cause of their unemployment. A general breakdown of unfilled job openings appears to sustain this view. (See Table V.)

TABLE V *

Occupation	November 1966 Percent of Total Unemployment	July 1966 Percent of Total Unfilled Job Openings
Laborer	16.8	9.6
Service worker	19.0	9.5
Operative	19.7	7.9
White Collar	15.3	60.0
Craftsman	5.1	13.0
Never Worked	13.1	---
Not reported	11.0	---

*Source: "Sub-Employment in the Slums of Boston, "U.S. Department of Labor. Occupational information of the unemployed is based on occupations last held.

This table is a further indication of the increased demand for skilled workers. The Department of Labor concluded among other things that:

> There is unquestionably a shortage of unskilled jobs in, or even near, the slum areas.
>
> Many jobs that are available are characteristically low-paying -- below the "poverty" level.
>
> New plants (with their new jobs) are increasingly built around the perimeter of Boston, far away from the slums.

Thus, one of the central problems for the sub-employed residents of the city is the lack of skills required in Boston's increasingly skilled labor force.

Labor Force Opportunities

Another employment problem results from the increasing number of jobs in the suburbs where they are not as accessible to city dwellers. This is particularly significant in the cases where businesses previously located in the core move to the suburbs. Such industrial moves are costly for employees, particularly those residing in the core. This was revealed by Everett J. Burtt, Jr., of Boston University in a study of firms relocating from Boston to the suburban ring ("Workers Adapt to Plant Relocation in Suburbia", Monthly Labor Review, Vol. 91, No. 4, April, 1968, pp. 1-5). Burtt found that if workers who reside in the city quit their job and seek another job in the core when their employer moves, they must try to find the new job in the face of the declining employment opportunities in the core; if the workers keep their jobs and remain in the city, they face both commuting time and costs; or if they remain with the firm but move to the suburbs, they incur increased housing costs without any visible improvement

in the quality or living space of the new residence. Burtt found that those who opted for the first alternative had the highest average number of dependents, the lowest educational level, the highest percentage of blue collar workers and the lowest average wages when compared with those who remained with the firm after relocation and those hired by the firm after relocation.

For those city dwellers who remained with the firm after relocation, commuting became a more expensive and more time-consuming operation. They experienced a 68.9% increase in commuting. While 87.4% of them had used a car to commute prior to relocation, 100% relied on an automobile to commute to the new location. Burtt also found that when there was a change of residence it was invariably closer to the new work location, thus indicating a desire to decrease commuting time. Where the increase in commuting time was no more than 10 minutes the workers did not express any objection to the increase, particularly since commuting to the new location was considered more comfortable and traffic conditions were viewed as being less difficult. However, where the increase was 15 or 20 minutes, the commuter viewed the change as unfavorable.

It is clear that industrial moves to the suburbs not only decrease Boston's tax base and attract many workers to the suburbs but is also very costly to core residents who lose their jobs and face decreased employment opportunities in the core.

SOCIAL PROBLEMS

Boston is experiencing many of the same social problems being felt in all large U.S. cities. These are problems of adjustment to new ways of life, new attitudes towards people and ideas, new social mixes, new kinds of jobs, new educational needs, new recreational choices, new transportation problems, and others. Some of these problems are more severe in Boston than elsewhere, some less. And there are a few which are uniquely Boston's.

The number one problem in most American cities, and that which Mayor White has labeled as the most important in Boston, is race relations. This is a thorny issue in Boston, unquestionably, but not as difficult as in some other cities. Relative to other cities, the black population is quite small, it is articulate and well-led, it is relatively moderate and has developed, good, and growing, communications links with the white leadership, it is better educated and better housed, and it has access to, and holds, better jobs. It should be stressed that these are relative statements, compared to other large U.S. cities. In all these respects, the situation of the black community is still unsatisfactory by any objective measure: the Negro's position is decidedly poorer than that of the whites, and enormous efforts are still needed by both whites and blacks to right the balance between the two races. Also, highly sensitive political and civic leadership will be needed on both sides to maintain the relatively good relationship between the two that now exists.

Specifically, the blacks of the Boston Metropolitan area are still largely locked into the Roxbury ghetto, with only some 20% living elsewhere (most of them in the Cambridge Negro districts). The disparity between races has been well documented in the United Community Service report, "Black and White in Boston, 1968".

The findings of this report suggest that the status of the Negroes in the city is a central problem which must be taken into account in most policy decisions made in the city. Negroes' demands for a high degree of control over their own destiny also suggest the importance of developing new mechanisms for encouraging active participation of all important groups, black and white, in the city's decision-making process.

In terms of the numbers affected, however, the plight of the whites in Boston represents an equally serious problem. It is only less serious in terms of intensity and the availability of alternatives for many. Stated in its most general sense, Boston's white community--which is largely lower middle class -- has been confronted with a wide variety of pressures in the past two decades or so which are combining to make life in the city increasingly difficult and unpleasant. The result of this is the continued flight of white families to the suburbs, resulting in the largest percentage decline in central city population among big cities in the United States.

Our knowledge of the specific reasons for these departures is limited, but intuitively it would seem that it is a combination of: deteriorating city services, high rents and obsolete housing, a relatively poor school system, high taxes, declining urban amenities, traffic congestion, poor (and expensive) public transportation, racial tensions, reduced personal security, etc. Put more generally: the popular image of what middle-class life should be is increasingly unavailable within the borders of the city. Thus, when people achieve the level of affluence which makes the move to the suburbs possible, the move is made.

The widespread theory that there is a major trend of higher-income people back to the cities from the suburbs is believed by the data. Studies done at MIT recently of new luxury apartment developments in Boston show clearly that a very small minority of the new occupants of these flats comes from the suburbs.

If the rate of departure of middle-class and younger citizens continues, the city will ultimately be largely populated by blacks and other minority groups who have no choice because of housing discrimination in the suburbs, single people and students, and a few high-income-apartment and town-house dwellers.

The presence of a huge population of students in the city presents Boston with a rather unique social problem. Large areas of the city are seriously impacted by these temporary residents, and the

"hangers on" that follow them, notably Beacon Hill, Back Bay, Brighton-Allston and, increasingly, the South and North Ends. The effects of their presence are high rents, lack of concern for local services and amenities, noise and congestion, an active drug trade, and other factors which tend to drive families elsewhere.

It should be noted, however, that the presence of educational institutions and large numbers of students in the core city is a major factor in strengthening the downtown area as a shopping and recreational center, thus making it more attractive to other groups as a center of activity.

POLITICAL PROBLEMS

One of Boston's greatest assets is the quality of the political leadership it continues to spawn. A second important factor is a general willingness in the local culture to allow problems to be dealt with through the political process, i.e., Bostonians, unlike some other communities, do not insist that solutions to tough problems be left entirely to private enterprise. The past three mayors have recognized that good working relationships with the private business sector are a vital necessity in dealing with many of our city's problems, but it is nonetheless recognized in Boston that the Mayor has an important leadership role to play.

But probably the greatest defect in the system is the severe lack of authority available to the Mayor. While he is a "strong" mayor in his formal powers with respect to interval city responsibilities, he is limited from many other directions. First, there is a long history of state involvement in local decision-making. Second, the very small physical size of the city, compared to the total metropolitan area, limits the functions that can be effectively handled by the municipality. These two factors have combined to lead to the creation of a large number of authorities and commissions over which the city has little or no formal control, notably the Metropolitan District Commission, the MBTA, the Mass. Port Authority, and the Mass. Turnpike Authority. In addition, such state agencies as the Department of Public Works severely limit the freedom of the city.

On top of all this, and across the board, the state imposes one of Boston's most severe problems upon it through the state-wide civil service system. The system is both obsolete and politically vulnerable to the point where it is extraordinarily difficult to attract qualified professional skills into the city's public services. The effects of this are seen in the unusually difficult problems the city has in performing normal public services of high quality and at reasonable cost.

Probably the greatest single political problem facing the city is the cost of its operation. Studies at MIT in the past few years of Boston's public finances have primarily revealed the complexity of the problem, rather than any near explanations or solutions. Comparisons with other cities suggest that Boston spends more per capita than any other city of comparable size, as much as three times more than some. Breakdowns by function indicate that the heaviest spending (relative to other cities) is found in such services as police, fire, and health services. But, there are other functions that are short-changed. The lack of comparability of data, the difficulty of acquiring full data on contributions to and by other levels of government (county, metropolitan authorities, state, and federal), and other defects in information make it impossible to fully comprehend the ingredients of or reasons for Boston's high costs. But, unquestionably they are high and a problem of almost crisis proportions. "Solutions" will elude the city until the problem is fully understood. Substantial research on the subject would likely have a beneficial payoff.

Another factor that must be considered is the political structure of the city. Whether it is seen as a "problem" depends on one's point of view. It has certain virtues and some defects, unquestionably, from anyone's viewpoint. In terms of formal structure, it is a "strong mayor" system, with the complementary "weak council". The last several administrations (since the reform) have demonstrated that these are relative terms and depend greatly upon the individuals holding the offices. But the system is clearly weighted in favor of the mayor, and the Councils' powers to act are very restricted by the charter. The system is that recommended by the National Municipal League in almost every detail as the ultimate in reform systems (short of a city-manager), and has been in effect since the 1950's.

The structure provides for non-partisan elections with the Councilors elected at-large. Both Mayor and Councilors are elected in a two-step elimination system, in which the first election provides the nominees, two for each office. The school committee, as in all Massachusetts communities, is elected separately, but by the same system The Mayor has a four-year term, the rest two-year terms. There are no other elected city officials. The city performs most of the functions of Suffolk County (although the voters also elect a sheriff), and pays all the bills of the county, despite the fact that there are two other towns in the county (Revere and Winthrop).

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Boston's strong-mayor system has largely resulted in what was intended: an executive with both responsibility and authority (within the limitations of city powers). The objective of the "strong-mayor system" with respect to the Council is to elect a council of "statesmen", who will be above parochial interests. "Statesmanship" suggests quality and the evidence since the reform is that quality has improved substantially. But, instead of eliminating parochialism, it has tended to give special emphasis to certain neighborhoods which succeed in getting some of their residents elected, while many other neighborhoods are left out and often ignored. A number of major sections of the city -- notably Brighton-Allston, South End, East Boston, Charlestown, and others -- are usually totally without representation. Until the present council, the Negro community and the "Yankees" were also without representation. Even today, such ethnic groups as the Poles, Jews, Greeks, Chinese and Puerto Ricans have no real voice in the Council. While parochialism may have been subdued by this system, the result has been an unbalance and in some cases a total lack of representation of neighborhoods and ethnic communities.

An important effect of this electoral system is that the people, not having a local representative in the city government, turn to their representative in the state legislature. Such actions tends to institutionalize and encourage state involvement in city affairs, and to reduce the ability of the city to deal with its own problems and be responsive to its citizens and neighborhoods.

The effects of this system have been more serious in education than in other policy areas. In the latter areas the presence of a Mayor elected by all the people has ameliorated the problem and provided a degree of statesmanship and leadership. In the field of education, no such chief executive exists; the system is run by part-time, unpaid school Committee members working with the school administration. And, the tradition does not exist in Boston today of electing to that Board people with experience in the field of education. The result, it is probably fair to say, is that the school committee members provide the majority of people in Boston with the kind of schools they want; they are representative of the voting majority.

The main problems arise from the fact that there are significant "sub-communities" within the city for whom the school system seems unresponsive to their needs. In part the problem is one inherent in any large organization: The difficulty of providing all the theoretically desirable flexibility needed by a heterogeneous society. The responses of these "sub-communities" differ; those Roman Catholics who feel their needs are not being met by the public schools send their children to parochial schools. The more affluent Protestants and Jews turn to the many private schools in the area. The Negroes, however, have neither of these choices and indeed have little choice but to fight the system. The Mayor has little power to influence school policy despite the importance of it to satisfactory race relations and Negro-city government relations in Boston.

Dissatisfaction with the high degree of centralization in Boston's government has been expressed in a variety of ways, but the most serious criticisms have been leveled by members of the Negro community. Between the 1950 reform and the election of 1967, there had not been a Negro on either the City Council or the School Committee. Although much attention was given to Roxbury by the Collins administration's renewal program, there was a growing feeling in the black community that they were not given an adequate opportunity to participate in planning their own destiny. In recent years, through the devices of the Model Cities Board, the experiments with neighborhood-school-advisory groups and anti-poverty boards, and the creation of a myriad of local neighborhood associations, the Roxbury community has been groping towards a system of effective local representation in the decision-making process. Also, in 1967, a Negro leader, Thomas Atkins, was elected to the City Council.

Other neighborhoods in the city have been less vocal on this issue, but there have been some visible efforts in this direction elsewhere in the city. For example, Charlestown residents demanded (and to some extent got) a stronger voice in their urban renewal planning. There was even some talk of submitting the renewal plan to a referendum. Also, during the last councilmanic election (1967), a number of the candidates expressed strong views favorable to a return to elections by wards. Furthermore, the "War on Poverty", through the creation of Area Planning Action Councils in low-income neighborhoods, has developed more effective local voices in the city.

This trend, which is nation-wide, seems likely to continue and to proliferate in future years. Indeed, it is probably the most interesting and exciting development in urban politics in several decades.

Boston, in one respect, is far better off than most American cities in its ability to move in this direction. It is said, with reason, that before you can decentralize government, it must be centralized. Many other cities are highly decentralized, but in a different way than the above; their authority is dispersed among many elected officials, quasi-autonomous boards and commissions, powerful councils, etc., leaving the chief executive with little real authority to run his city in a coordinated fashion. Such a city could not decentralize functions to its subcommunities without total charter reform. Boston's mayor can delegate responsibilities to the districts of the city -- within limits -- because he has this authority to delegate.

Environment

This category serves as a catch-all for the problems concerning physical renewal, city maintenance, air and water pollution, recreation facilities, traffic congestion, the attractiveness of the city, urban amenities and human values within the city. Not enough work has been completed to include this section in our report at this time.

3 DORCHESTER BAY AS A RESOURCE

Boston's problems are representative of both the core area and the larger region. No satisfactory solutions to these problems have been found by attacking them one by one; each problem appears to be closely interwoven with others. The need for a comprehensive approach towards meeting our urban needs has often been raised but what has not been widely recognized is that the harbor space represents a resource of sufficient scale to address many of these problems simultaneously.

The development of Dorchester Bay to meet Boston's problems depends upon many variables, many of which may be still unknown. The site itself requires further study although much work has already been done in this area. Investigation of the characteristics of the site have centered around the geology, the water quality and the problem of air noise. Issues related to eventual development have also been included in this study, specifically landfill, transportation and utilities.

Whatever type of development, if any, is eventually deemed best for Dorchester Bay will depend upon many factors; Development here must be weighed against alternative sites and alternative solutions to urban problems. At the moment, however, the Bay presents an unusual opportunity to explore new concepts in urban living and new ideas in the process of urban development.

FOUNDATIONS

Engineering Geology

Foundations engineers are concerned with four basic parameters: the depth to the bedrock surface, the strength of this rock, the thickness of the sediments overlying bedrock, and the compressibility of these sediments.

The depth to the upper surface of bedrock can be very important in determining the cost and nature of building foundations. If the bedrock is shallow, buildings may be supported on short piles resting on or in the rock. If, however, the bedrock surface is quite deep, say 150 feet or so, the cost of driving piles to bedrock may be prohibitive for all but the tallest buildings, where foundation costs may be distributed among many floors. In such cases the engineer may wish to consider other means of support, such as floating foundations, in which a large mass of soil is excavated to accommodate a deep basement, with the result that the net increase in load on the underlying foundation soils when the building is finished is negligible.

The condition of the soils overlying bedrock may relieve some of these problems, or it may only complicate them. Granular deposits such as sand and gravel are generally excellent matterials to build upon. They provide a firm soil relatively free from problems of settling. Mud and clay, on the other hand, will usually

compress appreciably under the added burden of a building or landfill, causing settlement. The amount of settlement is roughly proportional to the thickness of the clay and mud beds. Since the thickest beds of mud or clay are likely to be found in areas where the bedrock is deep, these are the same areas most likely to undergo severe settlement.

Bedrock

Most of Boston Harbor is underlain by a sedimentary rock known as the Cambridge argillite (also known as the Cambridge slate or Cambridge siltstone). This rock is derived from fine-grained muds which were consolidated under great pressure for long periods of time. It is generally strong enough to support heavily loaded piles or piers that might be used to support tall buildings (say greater than about 10 to 15 stories). There are, however, local "soft" zones whose occurrence is unpredictable and which are not strong enough to support heavily loaded piles and piers.

In some areas, the Cambridge argillite has been eroded away, exposing the Roxbury conglomerate or the Squantum tillite. (See Figure 1.) (These are sedimentary rocks composed of small pebbles or cobbles of other rocks which have been cemented together by consolidated mud or clay.) The Squantum tillite is considered a "soft" rock, but both the conglomerate and tillite will support moderately tall buildings. In any case, these rocks are found mostly under land areas rather than under the Harbor.

The Boston Basin

A large portion of Eastern Massachusetts was at one time a vast lake. This area, now known as the Boston Basin, includes much of greater Boston and the Massachusetts Bay. This lake has had a profound effect on the geology of the area, particularly the materials overlying bedrock.

Till

The entire Boston Basin has been covered by glaciers several times. As a result, much of the bedrock is covered by a layer of glacial till. Till, or "hardpan," is a mixture of boulders and rock debris left behind by the glaciers. The till itself is frequently strong enough to support building foundations. Thus, in many areas the depth to till is more significant that the depth to actual rock.

Unfortunately, while much geologic information has been gathered on land areas in Boston, little work has been done in the Harbor. There are relatively few borings in the Harbor, and the borings which have been made seldom reached bedrock or till. From information gathered on shore, some geologists have tried to extrapolate bedrock contours into the Harbor. (See Figure 2.) Unfortunately, the bedrock contours are confused by the existence of many depressions in the bedrock surface referred to as "buried bedrock valleys" or"Pleistocene river valleys." These valleys are known to exist, but their locations are less certain. The bedrock topography is quite irregular and in some areas the borings are too far apart to accurately trace the valley. In addition, the

reliability of existing borings is not always known. All too often borings come to rest in a boulder which is inaccurately logged as bedrock. Also, in transferring logs from one record to another, information is occasionally miscopied and never corrected. See, for example, figure 2.

Drumlins

Many of the Harbor islands are glacial features called drumlins. Drumlins are simply local mounds of till left by a glacier. As previously stated, till is often strong enough to support heavy foundations. In addition, many of the drumlins are reinforced by rock cores, either bedrock or intrusive dykes or ledges. Since the long axis of many of the drumlins is parallel to the motion of the glaciers (generally Northwest-southeast) many geologists feel the rock cores were essential in preventing the drumlins from being scraped away by the glaciers.

The northern half of Thompson Island (that portion occupied by Thompson Academy) appears to be a drumlin, though its axis is not in the common NW-SE orientation. This drumlin probably does

not extend into the southern half of the island, but the bedrock outcroppings at nearby Squaw Rock (Squantum) indicate that the bedrock contours are probably shallow under Thompson Island, possibly in the range of -40' to -80'. Some information is available for the Columbia Point area (Reidy, 1964). Here, bedrock contours vary from -100' to -180'.

Subsoils

The most prominent sedimentary feature of the Boston Basin is a vast deposit of soft clay known as the "Boston blue clay." The thickness of this clay varies from 0 feet to over 200 feet; its upper surface is quite irregular, showing a relief of over 100 feet within the Harbor. The clay was generally deposited in the still waters of the lake, and is thus a very fine-grained deposit. However, it also contains some lenses of silt, sand, and gravel.

The upper layer of the blue clay has been oxidized to form a generally firmer yellowish clay, referred to by Boston engineers as the "stiff crust". This oxidation occured at a time when much of the Harbor was once above sea level.

Above the yellow clay lies a thin (5 feet to 10 feet in most places) layer of fine silt, and a thicker layer of black, organic mud. This mud has a high carbon content, generally attributed to sewer outfalls in or near the Harbor. (Mencher, Copeland, and Payson, 1968). It is

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highly compressible and will not support structures or landfill. In addition, the mud often contains trapped gases, making it a reflector of seismic waves. This property makes impossible some forms of seismic study which are cheap and fast, notably the electronic pinger method developed by Dr. Harold Edgerton of MIT. (Payson, 1963) The normal thickness of these mud deposits is less than 15 feet. However, in parts of the inner harbor and Dorchester Bay, the mud beds are about 40 feet thick.

The southern half of Thompson Island appears to be a gravel outwash which extends at least to the mouth of the Neponset River. The surficial deposits surrounding Thompson Island are mostly mud with some sand and gravel. There are large pebbles and cobbles on most of the beach surrounding the island, and there are extensive clam beds on the southern and western beaches. The thickest mud beds in Dorchester Bay occur just west of Thompson Island, in the channel adjacent to the island (from the Neponset River).

Carson Beach and parts of the Old Harbor have sandy bottoms, apparently underlayn by thick beds of soft clay. Columbia Point consists largely of fill contained by rock rip rap and surrounded by mudflats.

At present very little geologic information is

available for the Harbor. The Boston Society of Civil Engineers handbook, Boring Records for Greater Boston is somewhat dated, but a new edition is currently being prepared. It is hoped that any information available from municipal projects (utilities, etc.) or private developers will be included in the new edition. In addition the BRA is currently negotiating a contract for a seismic survey (plus a few borings, where needed) of the Dorchester Bay area.

Construction

Since Thompson Island appears to be built on a drumlin and shallow bedrock no foundation problems are anticipated for construction on the island itself. Foundation conditions would be similar to those found in other drumlin areas (e.g. Beacon Hill, Telegraph Hill, Savin Hill). However, it is expected that the new community in the Harbor might require landfill to enlarge the island or to create new ones. As in the underlying soils, mud or clay fill can be expected to compress appreciably; sand and gravel fills will compress very little. (It should be pointed out that if sand or gravel fill is placed above thick beds of clay or mud, the soil will still settle, due to compression of the clay or mud.) Foundations conditions on filled land or in water adjacent to islands might be similar to other filled areas, such as Back Bay.

The type of fill needed for a particular landfill depends upon the use to which the new land is to be put. In an area which is to support high rise apartments with massive utilities services, small amounts of settlement of the landfill can seriously damage the utilities connections. On the other hand, in areas designated for playgrounds or one story

dwellings, the expected load is much smaller, and settlement is not expected to be a serious consideration.

Granular fill material is generally superior to clay or mud, but granular material is also more expensive to place. Clay fill generally requires piles to support building foundations. As the clay consolidates, its volume decreases. If the clay settles around a pile, it may come to rely upon the pile for support, instead of lending frictional and buoyant support to the pile. This effect, known as "negative loading", may cause failure of the pile unless the pile was designed to support the additional load. On the other hand, well placed granular fill will often support foundations and utilities without piles, provided the natural foundation soils beneath the fill are not themselves too compressible. Thus, the final decision to use sand or clay should not rest solely upon the initial cost difference of placing the fill.

Two other schemes need to be mentioned at this point. First, it has been suggested that some buildings in the Harbor may be supported by a structural deck on piles. This method has several advantages, the most obvious one being that it does not interfere with tidal flow. However, preliminary studies show that this technique is expensive, in the range of $10 - $15 per square foot of deck, exclusive of piling costs.

The second possibility is that of floating a building in the Harbor. It is generally agreed that for our purposes such a structure could not be literally "floating". The problems of anchoring, wind loading, and building motion would probably be prohibitive for a small building in close quarters. However, it has been pointed out that such a building might be prefabricated on shore, floated into position, and then "sunk", allowing it to rest on the Harbor bottom. It would be possible to support much of the weight of the building boyantly, allowing only a portion, say 20% - 40%, of its weight to rest on the bottom. Thus, the load on the underlying soils would be lessened, perhaps avoiding some of the problems of settlement, etc., but the building would still be stable in winds and waves. Later, if it was desired to re locate the building, it could be "re floated" and placed in its new site with nearly the same flexability as a purely floating structure.

We wish to stress, however, that MIT is not recommending this technique. It has not been studied in detail and is mentioned only as a method which perhaps deserves further study.

Conclusions

Foundation conditions in Boston Harbor are determined essentially by the depth to bedrock or till and the thickness of the Blue clay under the building site. Unfortunately, the depth to bedrock is known in only a few locations, and the clay is presumed to be thick in most areas where rock or till does not outcrop. Most of the islands are drumlins or outcrops of rock, and are generally considered good foundation sites. However, if landfill is required, the areas adjacent to the islands may have considerably worse foundation conditions than the islands themselves.

Until some data are available from the seismic survey, no reliable conclusions may be presented. Meanwhile, we will direct our attention towards the other techniques mentioned, namely structural decking and semi-floating buildings.

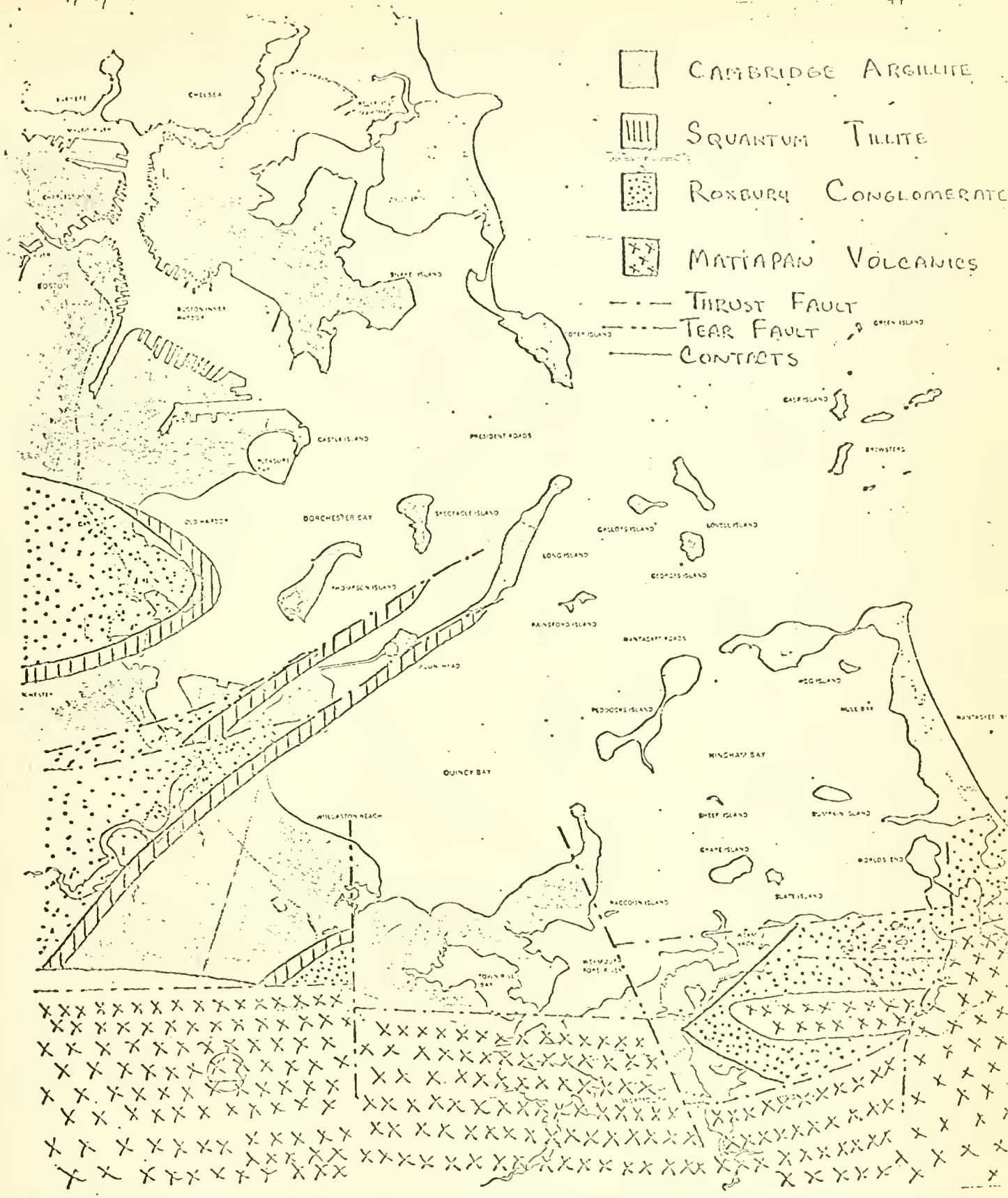

Figure 1. Bedrock Types under Boston Harbor
(After Billings 1929)

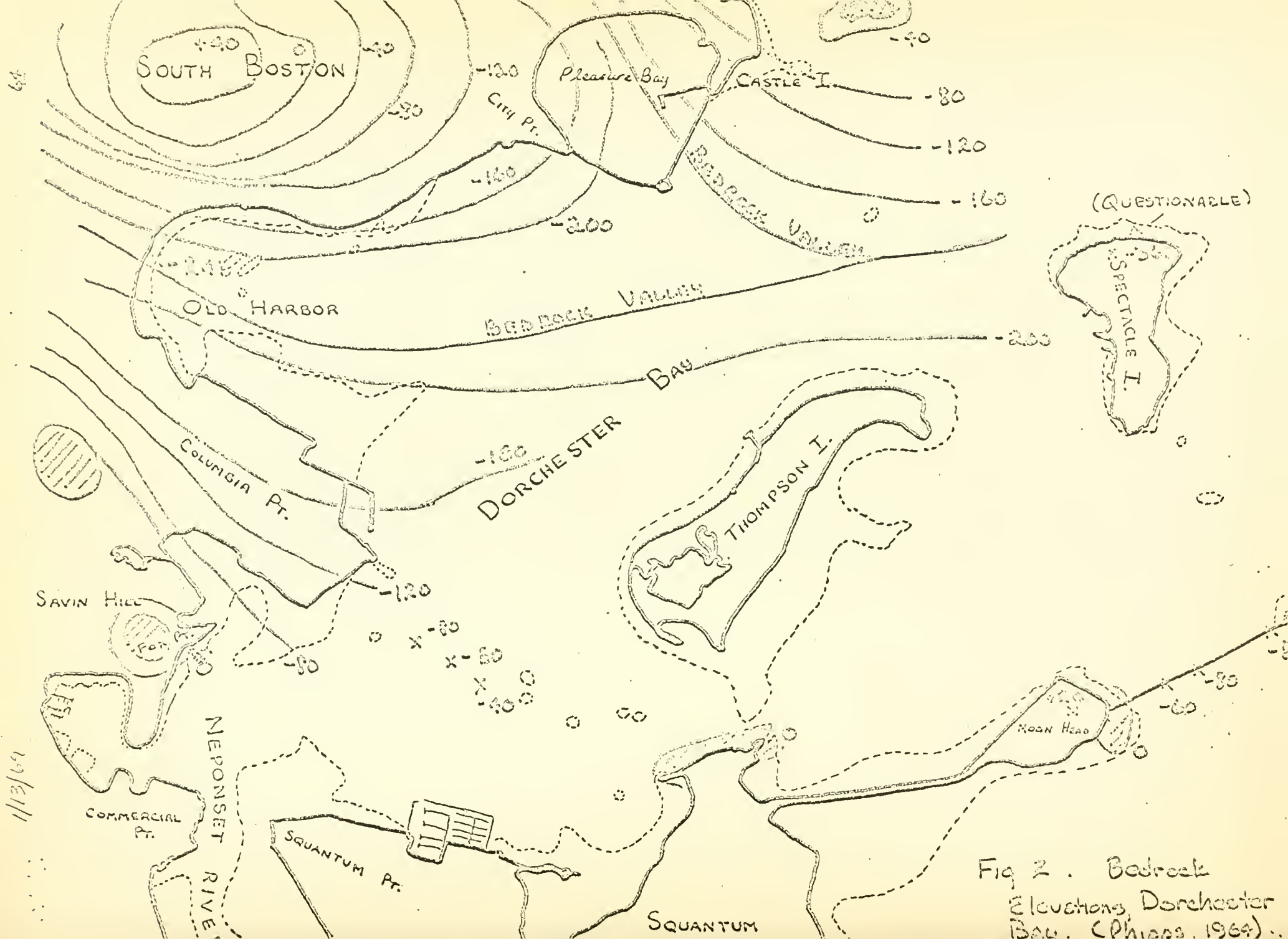

Fig 2. Bedrock Elevations, Dorchester Bay. (Rhoads, 1964).

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WATER POLLUTION

The quality of the water in Boston Harbor is not high; parts of the Inner Harbor are grossly polluted and water in other areas is so marginal that it threatens beach closings and restricts shellfishing. Control of water pollution is a major issue and any Harbor development must be planned to avoid contributing to the problem.

Water pollution problems manifest themselves in four ways: by creating health hazards, by threatening marine life, by creating navigational hazards, and by becoming an esthetic offense. In order to get some grasp on the existing degree of pollution, it is necessary to find measurable indicators which can yield quantitative information about the level of pollution. Such information, applied to our knowledge of water currents or proposed changes in water currents, allows us to predict the effects of development on the pollution in the Harbor.

Water Quality

In Massachusetts, three basic classifications have been established for water quality in estuaries & coast wate Class SA describes the cleanest waters, suitable for all recreational activities. Class SB describes marginal waters that are still legally tolerable for swimming and restricted shellfishing but not entirely clean. Class SC describes waters that are not suitable for swimming or shellfishing, but are still suitable for boating and fin-fishing.

Various means are used in establishing water quality standards. Dissolved oxygen is important in sustaining marine life, and is thus used; coliform bacteria are significant because they coexist with pathogenic bacteria which endanger human health. Other factors contribute towards creating esthetic or navigational problems, such as decomposing organic matter and floating debris.

Additional indicators, not used as legal measures of pollution, are also important measurements of pollution. Polychaete worms, for example, live in polluted waters, feeding on the organic matter found in sludge deposits. Because their population density usually varies as the degree of pollution, they are a rough indicator of substandard water. Similarly, phytoplankton, when present in unusually large numbers, indicate a condition of rapid depletion of the supply of dissolved oxygen in the water, thereby posing a threat to marine life.

Pollution Measurements

In measuring pollution, such indicators as dissolved oxygen, coliform bacteria, dissolved nitrogen and phosphorus (both plant nutrients in dissolved form) and others can be measured directly, and legal limits on their concentrations may be established. SB waters, for example, must never contain less than 5 milligrams of dissolved oxygen per liter of sea water. This may not be an entirely satisfactory indication of whether water is suitable for swimming, for a simple lack dissolved oxygen is in no way a direct health hazard.

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On the other hand, a limit has been set for the maximum allowable concentration of coliform bacteria, and this has more relevance to the health problem. A general picture of pollution is obtainable by use of Biochemical Oxygen Demand (BOD) measurements. BOD is a measure of the amount of oxygen that would be consumed by decomposing the dissolved and suspended organic matter in a given amount of time. For example, a common measure indicated the amount of oxygen that would be consumed in 5 days, at a constant temperature of 20 degrees Centigrade. The BOD gives an indication not only of the tax on the oxygen supply of a body of water, but also of the amount of potentially decomposable organic material present. Crude calculations have shown that about 400,000 pounds of oxygen demand enter the Harbor daily, the major sources being Metropolitan sewerage treatment plants at Deer and Nut Island. Data on reaeration in the harbor are not presently available; crude estimates show that the reaeration rate is probably much lower than the BOD input rate. Thus, it is evident that transport of pollutants out of the harbor is important in preventing the harbor from becoming devoid of marine life.

Nutrients, such as nitrates, phosphates, and other forms of dissolved phosphorus and nitrogen, affect the abundance of plants and phytoplankton in the water. If this marine growth becomes overabundant, it can seriously reduce the level of dissolved oxygen in the water. Nutrients from treated sewage also encourage the growth of sea lettuce, and, during low tide, sunlight decomposes the lettuce growing on tidal flats. This decomposition is accompanied by the nauseous odor of hydrogen sulfide

gas, which can also discolor housepaints in the locale. Winthrop has been forced to remove its tidal flats by dredging to solve this problem.

Pollution Sources

It is convenient to categorize the sources of pollutants that are found in Boston Harbor into eight groupings.

1. Direct sewage discharge

Raw sewage enters the harbor from illicit discharges from shoreline structures, or from sewer lines not connected to the MDC system. Although efforts are being made to eliminate these illicit sources, some buildings still exist which discharge sewage directly to harbor waters.

2. Combined sewer outlets

Raw sewage also comes from malfunctioning or storm-loaded combined sewer outlets. Much of Boston and adjacent areas is served by combined sewers, which handle both sanitary sewage and storm runoff. These sewers are designed to handle normal loads, but when a heavy rain occurs, the overflow, containing raw sanitary sewage, flows into the harbor waters and local rivers. In addition to this storm-caused discharge, several outlets allow frequent or constant discharge of sewage, due to malfunction or local sewer overloads. A map of known outlets and their condition appears in Figure [. Unfortunately, there are no estimates as to the quantity of sewage being discharged, although the amount is substantial. Since this is probably the most significant source of pollution in the inner harbor, further investigation is needed to evaluate the magnitude of the problem.

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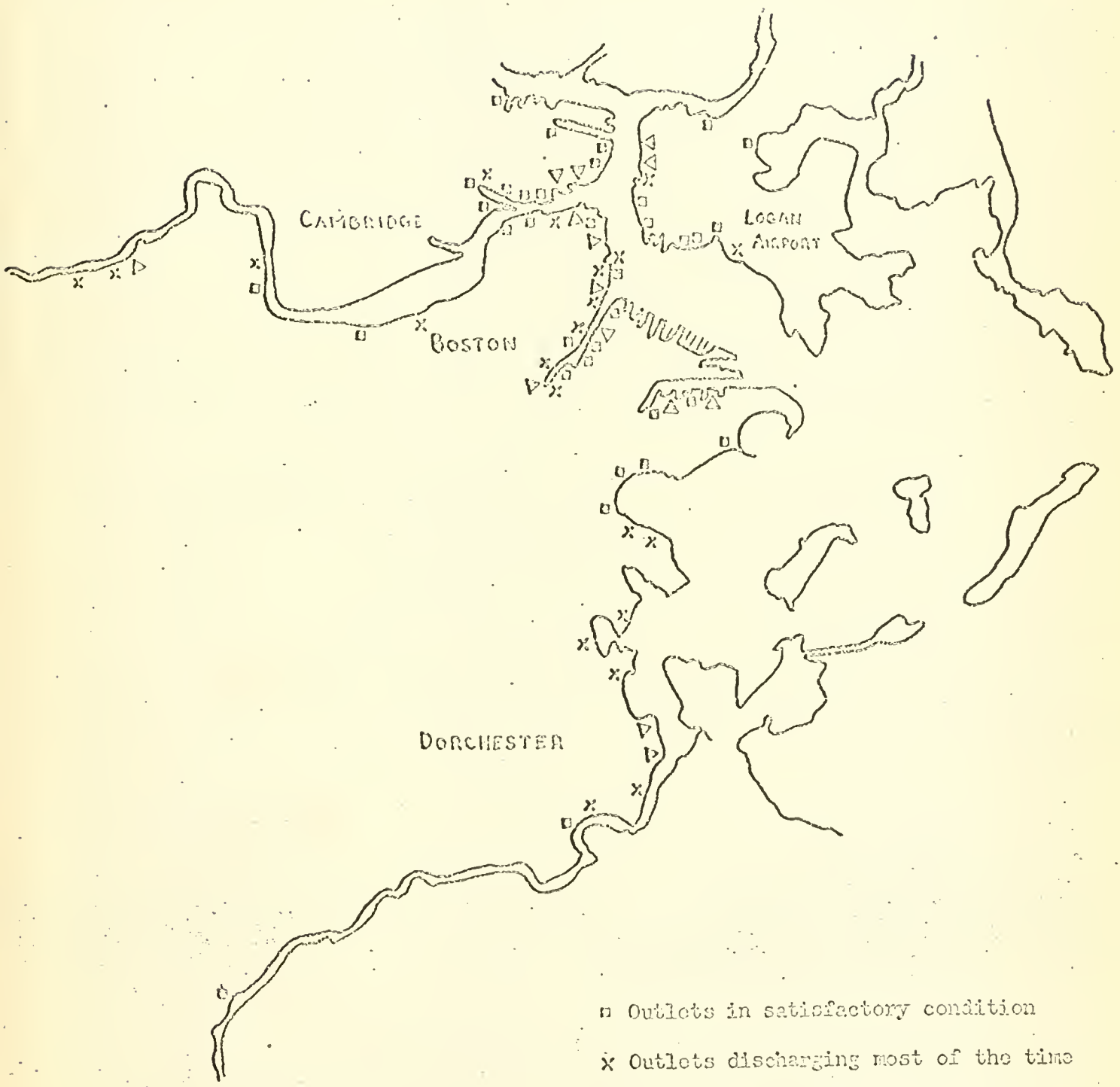
Figure 2. Combined Sewer Outlets in Boston Harbor



□ Outlets in satisfactory condition

X Outlets discharging most of the time

△ Outlets discharging all of the time

Data from Camp, Dresser, & McKee report; September, 1967

3. Watercraft sewage

Sewage is also discharged from commercial and military shipping and from pleasurecraft. Very few large ships are equipped with sewage treatment facilities, so wastes are discharged directly into the water. This problem is especially important in areas where ships are docked for significant period of time. Similarly, waste discharged from pleasurecraft can be a serious problem when there is heavy use of the craft docked at marina sites. Marinas are usually partly enclosed for storm wave protection, consequently there is usually insufficient natural water flow to adequately flush any amount of wastes.

4. Treated sewage

Partially treated sewage continually flows from Metropolitan District Commission treatment plants at Deer Island and Nut Islnad. These plants discharge a total of about 750 cubic feet per second of partially treated sewage wastes. Though some of the BOD has been removed, these effluents are still rich in plant nutrients; moveover, removal of pathogenic bacteria is very much dependent on chlorination of the effluent.

5. Treated sludge

Partially treated sludge is also discharged from Deer and Nut Islands. As raw sewage reaches the treatment plants, the floating scum and sinking sludge are mechanically removed for separate treatment. Eventually, the treated sludge is dumped into the harbor, and most of it is flushed out of the harbor by tidal currents. Undoubtedly, some of the sludge is dispersed, and later deposited within the harbor at various points as silt. At times, however, the sludge can build up on the harbor floor, causing depletion of dissolved oxygen during decomposition, or it can occasionally be carried to the surface, creating unsightly and malodorous conditions.

6. Oil spillage

Oil spillage occurs from shipping activity. Occasionally in oil transfer operations, especially at terminals on the Chelsea River, moderate quantities of oil are spilled. Some oil may find its way to other parts of the harbor, where it may persist for considerable periods. It is extremely doubtful whether a large spill, especially in the outer harbor, could be contained at all.

7. Industrial wastes

Industrial wastes discharged into the Harbor may contain a variety of undesirable compounds, or may cause local marine life damage by heating the water. Presently, there do not seem to be any problems of major significance arising from direct discharge of industrial wastes into the harbor, however, further data is required to properly evaluate the significance of these sources.

8. Debris

Debris originates from shoreline demolition, dumping and disposal operations, dilapidated structures, abandoned vessels, and general refuse litter. This constitutes the greatest eyesore, as well as a very real hazard to small craft. Decaying wharves occasionally release large timbers into the harbor waters, capable of causing hull damage.

Table I relates the detrimental effects of water pollution to the sources of the pollution. Water quality measurements for Class SB waters are also given. The most prevalent pollutant in the waters of Boston Harbor is sewage, in its many and varied forms. Raw sewage carries pathogenic bacteria, plant nutrients, and organic matters capable of producing unpleasant odors. Even treated sewage, which is poured into the Harbor in great quantity, contains nutrients

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TABLE

LLUTION OBLEM	DETRIMENTAL EFFECTS	MAIN CAUSES OF PROBLEMS	INDICATORS OF PROBLEM	REASON FOR USE OF THESE INDICATORS
ALTH ZARD	Gastrointestinal diseases caused by eating shellfish taken from affected waters infection & disease caused by body contact with water	high bacteria count in water	measurement of coliform bacteria especially fecal coliforms which originate from human waste	coliforms coexist with other more harmful bacteria thus giving a good measure for estimating the potential health hazard in the water.
JURIOUS MARINE FE	absence of shellfish and finfish	depletion of the dissolved oxygen supply in the water	direct measurement of dissolved oxygen	direct measurement of condition necessary to sustain marine life
			number of polychaete worms per square foot of bottom area.	polychaete worms thrive on organic wastes, hence their concentration is an indication of the undecomposed organic content of bental (sludge deposits in the Harbor. Decomposition of these deposits lowers oxygen levels.
			number of phytoplankton per milliliter of water	in the absence of direct sunlight, phytoplankton use up dissolved oxygen.
THETIC FENSE	Proximity to the Harbor made less desirable	unpleasant odor and unsightly appearance	odor	noticeable
			appearance	noticeable
AZARD TO AVIGATION	Possible injury or economic loss	floating and submerged debris	appearance or contact	noticeable

I.

INDICATOR SCALE FOR CLASS SB WATERS	CONTRIBUTION OF MAJOR SOURCES TO THE PROBLEM P=Primary S=Secondary									SPECIFIC ASPECTS OF THE PROBLEM
	1	2	3	4 bact.	4 nutr.	5	6	7	8	
coliform bacteria not to exceed a median value of 700 per 100 millilters, and not more than 2300 in more than 10% of the samples in any monthly sampling period.	P	P	P	S		S		S		presence of bacteria
not less than 5 milligrams dissolved oxyzen per liter of seawater at any time.	P	P	S			S	S			depletion of dissolved oxygen
not used, although concentrations of more than 200 per quare foot are considered undesirable	P	P	S			S	S			presence of polychaete worms
not used, although more than 1,000 per milliter is considered undesirable	P	P	S		P					presence of phytoplankton
none allowed in such amounts that would offend	P	P	S			S	S			decomposition of sludge deposits
	P	P	P							presence of raw sewage
								P		presence of industrial wastes
	S	S	S		P					growth & decomposition of sea lettuc
water discoloration and turbidity not allowed in such amounts as to prevent use for swimming and fishing activities	P	P	P						S	discoloration and turbidity
	P	P	P			P	S			gases from decomposing sludge float
										rafts of sludge on surface
							P	S		surface oil
									P	floating or shoreline debris
none allowable									P	floating debris

for plant life. Oil, which is occasionally spilled in the Inner Harbor and other areas, has an unpleasant odor, and reduces the ability of atmospheric oxygen to become dissolved in the water. Industrial wastes may have a variety of unpleasant or harmful effects, although there does not seem to be a great problem with the toxicity of industrial wastes in the Harbor. Finally, floating debris of varied origins looks unsightly, and may create a serious navigational hazard for small craft.

Pollution Transport

Transport of pollutants out of the harbor is essential for the maintenance of a dissolved oxygen supply in the harbor. This transport is effected primarily by the tides; incoming tides dilute the pollutants in the harbor and the ebb tide removes substantial quantities of them. The extent to which this process occurs in local areas may depend very highly on shoreline configuration, water depth and the bottom contours. Thus it is important to consider any landfilling proposals carefully, to best try to avoid complicating circumstances.

Presently, relatively little is known about the details of water motion in the harbor, so that it is difficult to make estimates as to what would happen if development caused certain alterations. In order to prevent serious levels of pollutants from building up near beaches, action; excessive currents, however, create other problems.

In some cases, it might be possible to make accurate estimates of what effects landfilling would have, but this cannot be guaranteed; a physical or a mathematical model of the present situation might have to be constructed, and the proposed change performed in the model. From changes in the model behavior, one could then predict what changes would occur in the harbor. Model studies are expensive, costing anywhere from several thousands to several hundreds of thousands of dollars, depending upon conditions and the degree of accuracy required.

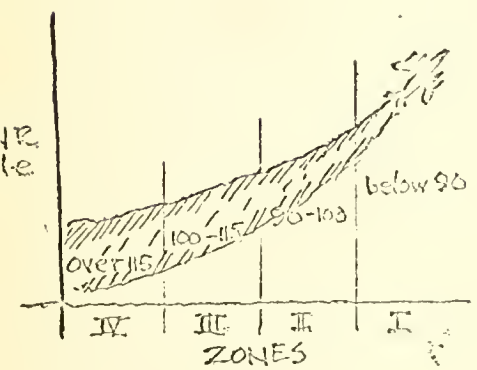
The most urgent requirements for further analysis are more complete and reliable data on sewage sources and transport; in particular, the combined sewer system contributions need better definition, and the effluents from the treatment plants need to be monitored. Lack of access to data was a major handicap in this preliminary study.

AIR NOISE -- DORCHESTER BAY

One of the undesirable features of the Dorchester Bay environment is the aircraft noise from nearby Logan airport. Because the site lies directly beneath the primary flight path to and from the airport, noise is more intense there than at many areas of equal distance from Logan. Response to noise is highly subjective and difficult to measure. Considerable work in this field is needed.

Measurement of Noise

Acoustical instruments are used to measure the actual noise (sound pressure) received at the point of measurement. The perceived noise level, measured in decibels (PNdB), is a function of the line of sight distance to the aircraft and the power of its engines. Since a person's sensitivity to noise varies with pitch, PNdB measurements are also a function of frequency.



The PNdB levels for a given location, when weighted to account for the time of day, the volume of air traffic and the annual runway utilization, give us a composite noise rating (CNR). This is a more useful measure of air noise; the CNR scale more closely corresponds to varying levels of human toleration to aircraft noise.

Around an airport and along the aircraft flight paths a series of contour lines can be drawn which define areas or zones of equal CNR levels. (See Figures 1 and 2) Within these contour intervals it is possible to judge the amount of noise interference with normal activities. Residents living

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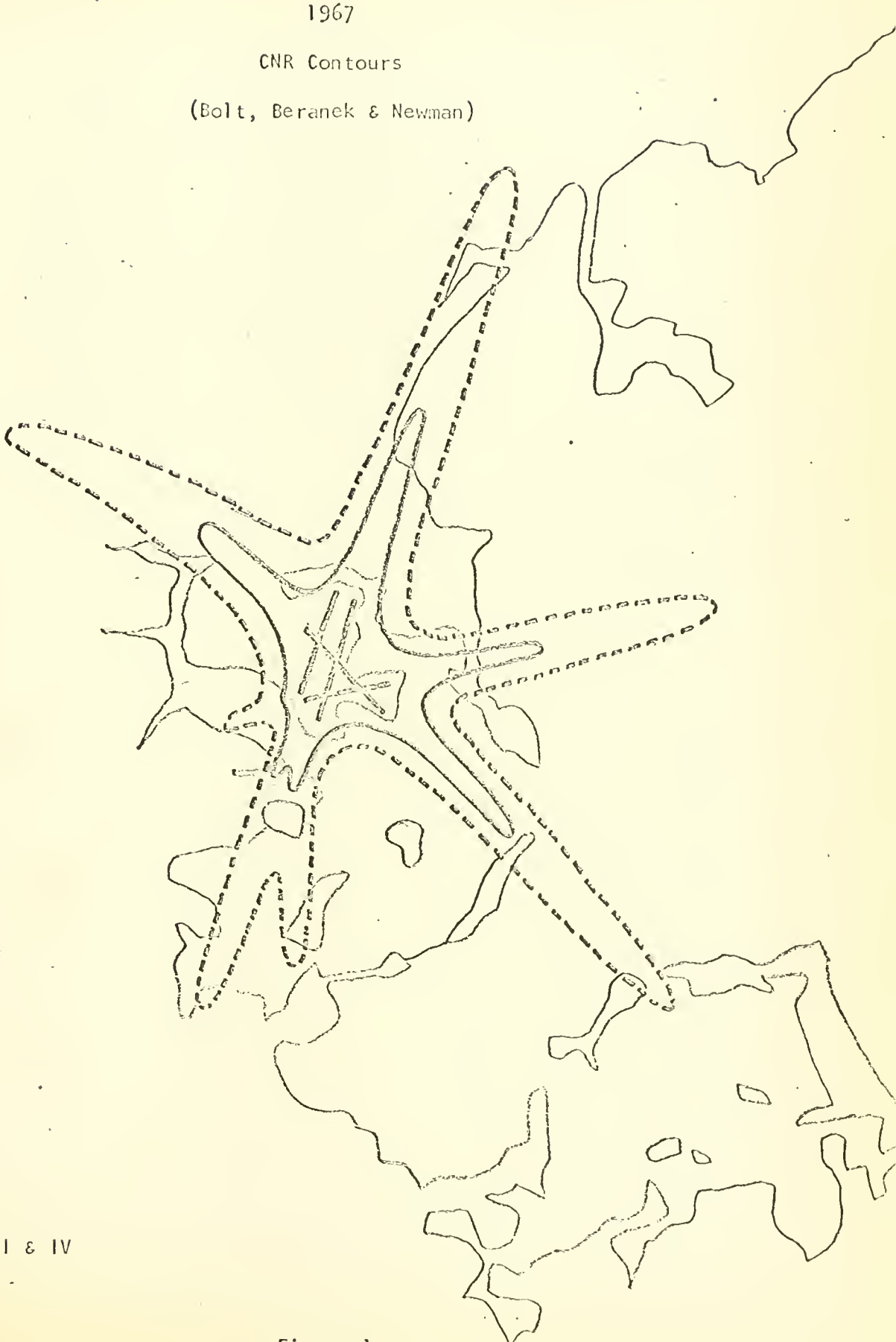
DAYTIME OPERATIONS

1967

CNR Contours

(Bolt, Beranek & Newman)



Zone II

Zone III & IV

Figure 1

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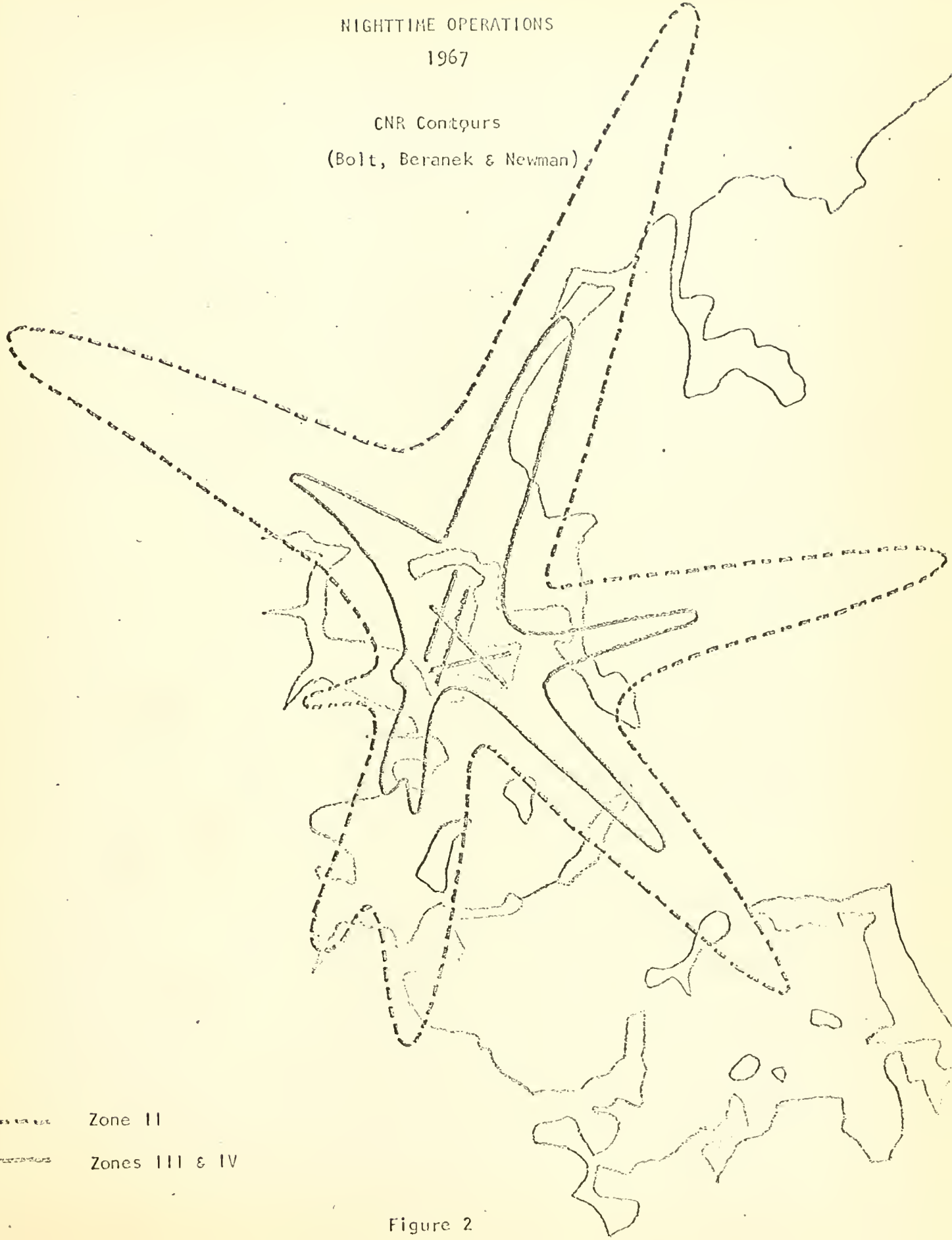
NIGHTTIME OPERATIONS

1967

CNR Contours

(Bolt, Beranek & Newman)



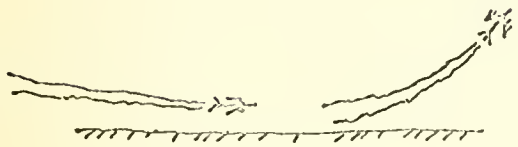
Zone II

Zones III & IV

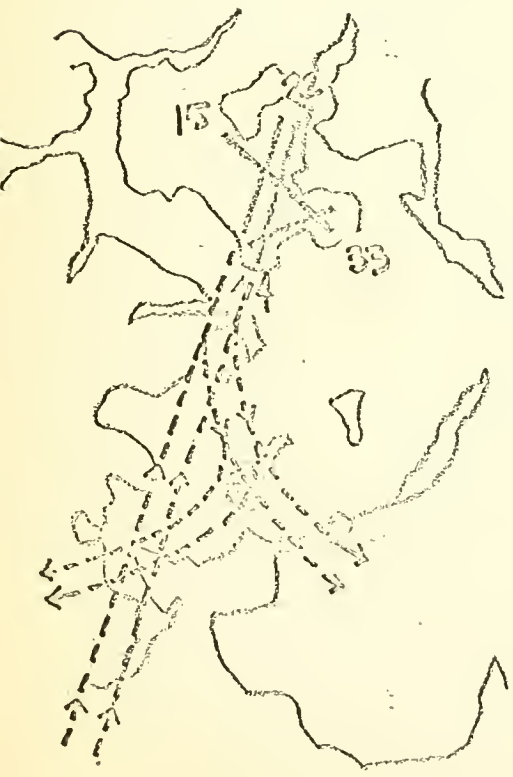
Figure 2

within zone II, for example, would have difficulty hearing a television or using the telephone during the several seconds in which the airplane was passing overhead. Table I relates these noise sensitivity zones to various land use activities.

Present Noise Levels



The CNR level of aircraft noise depends primarily upon the airplane's altitude and its power. Although airplanes use maximum power on takeoff, they tend to climb rapidly, thereby attenuating some of the noise. Airplanes approaching for landing, however, follow long, shallow (3%) glide paths and even on reduced power usually generate higher ground noise levels than on take-off. At Logan, runway 04-22 is mainly used for takeoffs in the summer and landings in the winter. Runway 15-33 is used all year for landings.



The takeoff and approach paths from Logan go directly over Dorchester Bay. Complaints from South Boston and Dorchester have caused the airlines to attempt to turn their airplanes away from the mainland during takeoffs; landings, however, must follow a straight line approach.

The CNR zones beneath these flight paths can be plotted, given the noise levels of various aircraft using the airport. Such contours are not reliable for predicting the effect of any individual airplane since it may not exactly follow the flight lines nor maintain the altitude suggested in flight regulations. Available information indicates that approaching aircraft usually fly closer to the ground than they need to fly.

TABLE I

LAND USE COMPATIBILITY CHART FOR AIRCRAFT NOISE

Noise Sensitivity Zone	Composite Noise Rating (CNR) Takeoffs & Landings	Residential	Commerical	Hotel, Motel	Offices, Public Buildings	Schools, Hospitals, Churches	Theatres, Auditoriums	Outdoor Amphi-Theaters, Theaters	Outdoor Recreational (Non-Spectator)	Industrial
I	Less than 90	yes	yes	yes	yes	yes	Note (A)	Note (A)	yes	yes
II	90-100	yes	yes	yes	yes	Note (C)	Note (C)	no	yes	yes
III	100-115	Note (B)	yes	Note (C)	Note (C)	no	no	no	yes	yes
IV	Greater than 115	no	Note (C)	no	no	no	no	no	yes	Note (C)

Note (A) - A detailed noise analysis by qualified personnel should be undertaken for all indoor or outdoor music auditoriums and all outdoor theaters.

(B) - Case history experience indicates that individuals in private residences may complain, perhaps vigorously. Concerted group action is possible. New single dwelling construction should generally be avoided. For high density dwellings (apartments) construction, Note (C) will apply.

(C) - Avoid construction unless a detailed analysis of noise reduction requirements is made and needed noise control features are included in building design.

Reference: Analysis of Community and Airport Relationships/Noise Abatement, Bolt, Beranek, December 1965, AD 645 955.

Projected Noise Levels

	Day	Night	Total
1967	151	29	180
1975	479	95	574

Annual Operations (1000)
(1967 FAA projections)

According to 1975 FAA projections, air traffic at Logan is expected to increase by 200% over what it is today. Although technical improvements in engine technology and impending Federal noise standards for aircraft may prevent the noise per airplane from growing much louder in future years, increasing traffic at Logan means that aircraft noise will be heard more frequently. Peak levels of 80 operations an hour (40 take-offs and 40 landings) occur now at Logan between 3 pm and 5pm. This peak might, with better air traffic control techniques, climb to 100 operations an hour and persist from 10am to 7 pm.

The projected noise levels for Dorchester Bay depend, in part, upon the future use of Logan in relation to the construction of a second major airport within the metropolitan area. Among the possible alternatives explored, only the switch to VSTOL short-haul traffic, distributed between Logan and several suburban VSTOL ports, might produce any reduction in existing noise levels. Whether commercial VSTOL aircraft will be operational by 1975 and whether airlines will use them for short-haul trips is not known.

CNR contour projections for 1975 are not yet available; D.O.T. is expected to publish these projections in March, 1969. Comparison of the 1967 contours, however, shows that the nighttime (10 pm - 7 am) period now governs, since nighttime residential activities (i.e. sleeping, watching television) are more sensitive to noise than daytime activities, and since ambient noise from sources other than aircraft are generally lower at night than during the day. Therefore residential use of the Dorchester Bay space is least preferable. Yet if all residences were sealed

from noise and air conditioned, the nighttime noise would be less important and daytime levels might govern outdoor use. Air traffic increases suggest that outside, however, all conversations would halt for at least 10-15 seconds once every 2 minutes throughout the day.

It should be noted that the noise sensitivity zones shown in Table I were derived from the response of residents already living in the community. A prospective buyer might view the situation quite differently; even moderate CNR levels might deter him from investing in a development, particularly if the noise level is expected to increase in the future.

Planning either a World's Fair or a new community in Dorchester Bay may well require special noise control measures which will increase the cost of construction. Table II shows the acceptable noise levels for various activities, both in PNdB and CNR levels. Further study is required to determine how much additional cost this acoustical protection will add to the price of structures. For Fair structures, once allowance was made for the reduction of interior noise levels, the frequency of flights would become less important. A simple feedback monitor on the P.A. systems could compensate for sound interference from outside. Additional studies on noise abatement systems are now underway.

Table II Acceptable Exterior and Interior Noise Levels

Activity	Acceptable Exterior Noise Levels (CNR)	Acceptable Interior Noise Level (PNdB)
Industrial	110-120	80-90
Store	100	70
Offices	80-95	50-60
Hotel	90	60
Residence	90	60
School	85	55
Theater	--	50
Concert Hall	--	40

LANDFILL USES

Landfill has been a traditional source of new land for Boston. Rising costs and an increasing awareness of the harmful side effects of reckless landfill projects have made this method of new land production one that requires careful attention. Landfill in the Harbor should be used sparingly and only when necessary, such as the creation of additional land space for projects which benefit the public or when employed to improve shorelines and enhance water areas.

Landfill Types

The types of fill most feasible for use in Boston Harbor are clay, dredged from the Harbor bottom and placed hydraulically, or sand and gravel, either dredged from near-shore areas along the coastline or excavated from borrow pits on land. Although hydraulically-dredged clay fill is cheaper than sand fill to place, it undergoes irregular settlement over a period of years, requiring higher costs for construction foundations and continual maintenance.

Granular fill material is superior to clay or mud for foundations. Clay fill, unless allowed to stand for 4 to 5 years, usually requires piles to support building foundations. Well-placed granular fill will usually support foundations and utilities without piles, provided the natural foundation soils beneath the fill are not too compressible.

The choice of fill material will depend upon the planned use of the new land. Small amounts of landfill settlements around high rise structures, could seriously damage the massive utility and service connections. Since loads in areas used as open space or for one story buildings are much smaller, settlement is not expected to be as serious a consideration.

Clay fill

The Boston Harbor area should contain sufficient quantities of clay for large landfill operations. Logan Airport, for example, was constructed primarily from hydraulic clay fill dredged from the Harbor bottom. Although the exact quantities of clay deposits are not known, a general geologic knowledge of the Harbor implies adequate supplies would be available if clay fills were economically and technically desirable. Care must be exercised that the removal of these deposits will not produce an adverse effect on the pattern of erosion and deposition on nearby beaches or in nearby ship channels.

Hydraulic clay dredging requires a pipeline supported on pontoons through which the fill material is pumped. Shipping channels cannot be crossed. When distances between the dredging site and the fill site exceed 10,000 feet, the clay is normally pumped into barges which are towed to the site and dumped. If the water at the landfill site is deep enough, the clay is directly dumped; otherwise, it is stockpiled near the site and hydraulically rehandled into position.

Sandfill

There are no known sand and gravel deposits of significant size in Boston Harbor. U. S. Army Corps of Engineers surveys of the New England coastline show that the closest "large" sand and gravel deposits are 49 miles to the north at Cape Ann and 39 miles to the south at Plymouth. Closer borrow areas do not appear to contain sufficient material for large scale landfill projects, and are very likely to be exhausted in the near future by sand and gravel companies or used for other landfill projects.

Moderate amounts of sand and gravel fill might be obtained from borrow pits on land. It is unlikely that very large quantities of such material would be available nearby, since most deposits within the area have already been claimed. About 3.5 million cubic yards of gravel are being transported 78 miles by railroad from New Hampshire to the construction site for a part of Route I-95 in Revere, Massachusetts.

Fill Placement

Hydraulic clay fill, placed by dredges operating either in the source areas or in stockpiles near the landfill sites, presents two technical problems. First, pockets of unusually soft material, when trapped within the fill, must be located and removed. Second, the discharge of muddy water spilling out of the fill area might require bulkheads or the establishment and operation of stilling basins to prevent unacceptable pollution in the local area. Sand and gravel fills should cause no unusual technical problems, whether placed hydraulically, from barges, or by end-dumping from the land.

Areas of the Harbor which are covered by a thick (greater then 5' - 10') layer of bottom mud present a more serious problem. Because this mud is very compressible, any fill placed on top of it is likely to undergo unacceptably large and uneven settlements. Excavation of the mud layer before placing the fill can be considered. This is expensive and if the dredged mud is not properly disposed of it could temporarily pollute nearby water and settle in boat channels.

Another approach might be to push fill out from the shore by bulldozer, in the hope that the advancing front of new material will displace the mud, forcing it out and ahead of the fill. There is a danger that pockets of mud will be trapped beneath the fill and that they will later cause severe local settlement. Also, the "mud wave" that forms ahead of the advancing front of the fill can cause serious local water pollution problems, if only temporarily. This technique, employed at Logan Airport, did not work satisfactorily. Mud was trapped beneath the fill and not only caused settlement but required additional material to extend the side slopes of the fill to insure stability.

Side Slopes

The edges of filled areas slope off gradually and extend underwater for a long distance from the above-water perimeter of the filled area. For sand fills, an underwater slope of 6:1 can be assumed, and for clays a slope of 20:1, provided that the bottom layer of Harbor mud has been removed before the fill was placed. Dikes might be used to contain a clay fill so as to avoid their extending unusually long distances underwater or interfering with navigation

Fill Elevation

The design elevation of landfill should be high enough above the water to prevent flooding. The cost, however, of additional landfill to reach an absolutely "safe" elevation may be greater than the cost of damage from occasional storm flooding.

The highest tide recorded in Boston Harbor was 15 feet. Adding to this a 2 foot allowance for wave "run-up" and an additional 1 foot for the rising sea level we reach 18 feet for design elevation. Absolute protection from the simultaneous occurrence of a maximum storm tide (an additional 6 feet for 100 mph winds), a maximum wave "run up" (about 3 feet), and another foot for the changing sea level, would require an elevation of 25 feet.

Landfill costs

The basic cost of fill material, assuming that it would be placed in 1972 or 1973, is estimated to be as follows:

Hydraulic clay fill: $1.00-$1.50 per cubic yard, plus $0.25-$0.50 for a booster pump for distances greater than about 3,000 feet.
Sand fill: $2.50-$3.00 per cubic yard, barged from offshore areas near Plymouth.
Sand fill: $2.50-$3.50 per cubic yard, from borrow pits on land, provided cheap rail transportation is feasible.

In estimating the cost per square foot of filled land, two additional figures must be added: the cost of removing mud from the Harbor bottom in areas where fill is to be placed and the cost of riprap for shoreline protection within the range of elevations affected by wave action. Out to water depths of 5 to 10 feet, the 1972-1973 cost per square foot of filled ground around the Harbor islands is estimated to be in the range of $2.00-$3.00 per square foot for hydraulic clay fill and $3.00-$4.50 per square foot for sandfill.

HARBOR TRANSPORTATION

Access

Harbor access involves both access to the Harbor from the metropolitan region and movement within and around the Harbor itself. ~~Because of the~~ To gain access to the Harbor, one must use the metropolitan highway network, the smaller feeder streets which lead to the Harbor's edge, and the supporting public transit systems which serve the immediate Harbor area. With the exception of traffic congestion during commuter hours and weekend holiday crowds, the highway network is adequate to bring a large number of people from the region to the Harbor vicinity. Local feeder streets, however, cannot handle the same volume without improvements. Public transit does not serve the Harbor to any great extent; Revere Beach and Carson's Beach are the only recreational areas accessible by rapid transit lines.

Traffic movement parallel to the shoreline is another problem. The Southeast Expressway and Morrissey Boulevard carry virtually all of the commuter traffic between the South Shore communities and downtown Boston. They are major bottlenecks during rush hours. The extension of the M.B.T.A. rapid transit line is not expected to relieve this congestion but may prevent it from growing worse.

Long-range development of the Harbor, therefore, requires a considerable improvement of access, particularly improvements in the local street net and the transit links to the core city residential areas. Thus, transportation planning for the Harbor must be tied into the transportation development plans for the entire urban core.

Intensive development of the Harbor would create new traffic flows that could not be handled by the existing system. The transportation facilities around the harbor are either overloaded or underdeveloped and are, therefore, inadequate for possible utility for harbor development. Major development in the Dorchester Bay area could not link successfully to the Southeast Expressway unless additional capacity was provided beforehand. The expansion of public transit access, perhaps in novel or innovative forms, could carry some of the traffic, particularly week-end recreational crowds if it were made attractive to them. But all additional capacity within the existing transportation system, as well as new transportation links within the Harbor, could be provided only by substantial expenditures.

UTILITIES

Preliminary discussions were held with the gas, electric, and water companies during November. The representatives of these companies foresaw no special problems in supplying their particular utilities to the Fair/community. However, lacking a detailed layout of the community, no demand figures nor costs are available.

Some additional information from each company is presented below.

Gas

A group known as GATE (Group to Advance Total Energy) is advocating the use of gas to generate electric power. The waste heat from this generation process is used to heat buildings and water, power air conditioners, etc. Before this concept is pursued, it is necessary to estimate the power requirements of the projects. The estimated cost of installing a Total Energy system is $1000/kw, although this price may be lower in the future.

Gas Companies are also looking into the problem of liquid and solid waste disposal. Processes such as the Prenco System (liquid wast disposal) and the Meltzit Destructor (solid waste, garbage) are possible markets for gas power. More information is being gathered.

Electricity

While the World's Fair is in operation, electric power would be supplied by Boston Edison to a central distribution point. (They have planned a new substation just south of Columbia Point which would help meet the demands of the project.) From there, each concession would pay for its own lead into the power source. If, however, it was known that a building would remain after the Fair as part of the community, then Boston Edison would supply power directly to the building via its easement, right of way, conduit, or whatever provision is made for utilities.

Water

Low service water connections could be made either at Andrew Square or in South Boston. Improvements in the city water systems are presently being undertaken, which further helps the situation. One problem which demands a closer look is the supply of fresh water for fighting fires.

Future Studies

There is no doubt that adequate utilities services can be provided for most developments in Dorchester Bay. MIT's contribution in the area of utilities will be primarily directed toward evaluating new techniques and processes in an effort to provide more efficient, reliable systems.

MIT will contact these utilities companies again when detailed utilities demands are known. In addition, work will include studies of sewage, waste removal, and communications systems. The latter will include usual facilities such as telephone, plus an investigation of the possible need of a Community Antenna Television (CATV) cable, to avoid TV interferance from low flying aircraft.

4. DEVELOPMENT ALTERNATIVES FOR DORCHESTER BAY

There are many possibilities for development, or preservation, of Dorchester Bay. Our analysis is limited to looking at those uses of the Bay which are most responsive to Boston's problems. The possibilities that we explore for this site might well be suitable for developments elsewhere in the city; at the moment alternatives apart from the Dorchester Bay site are beyond the scope of our analysis. These questions, however, will be raised again later.

Concept

The creation of a new urban community in the harbor offers many opportunities; it might for example, address the city's problems by providing housing and employment for its residents and by providing an attractive alternative to suburban expansion. Additional analysis, of course, will be required to determine whether a new community would be the best type of development for the site. If a new community is built it might also provide an urban laboratory for experimenting with new approaches to urban problems. Besides innovations in technology it may also be possible to introduce social and financial innovations in community building. Successful application of such innovative concepts would probably depend on their development on a large scale -- a scale made possible in Dorchester Bay.

Many of these proposals could be implemented through the creation of a new community in Dorchester Bay. As it is built over time, a new community could also provide an opportunity to experiment with new approaches to the solution of urban problems. The community could serve as a proving ground for ideas

which might be applicable on a wide scale throughout the country.. This is the theme of the proposed Bi-centennial celebration. The most significant innovation, however, which could be introduced by harbor development is the foresight to undertake large-scale, long-range planning and the creation of a viable institutional framework through which this process can be implemented.

Achieving Better Social Balance in Metro Boston

A desirable objective for Boston might be to achieve a better balanced social distribution in the city than now exists. Boston represents an extreme among U.S. cities in the disparity between the social profiles of its own residents and that of its suburbs. In part, this is the result of the small size (46 sq. mi.) of the city. But, in major part, it is due to a number of deficiencies in the city, particularly in housing, education, traffic congestion, inadequate policing, lack of job opportunities, poor public transportation, and others. (To the best of our knowledge, the reasons for these have not been documented.)

While the exact reasons for dissatisfaction with the urban life are not clear, the extent of the exodus to the suburbs is well-documented. It is also clear that it is middle-class whites who are moving out, and that they are being replaced in part by low-income Negroes and Puerto Ricans. While practically all of the new private housing built in the city has been high-rent, there is no substantial evidence to suggest that any significant number of these apartments are being rented to persons returning from the suburbs.

In other words, there is little evidence of any reversal in this trend. If it continues indefinitely, the character of the city will change drastically and its problems will become even more unmanageable than they seem today. We believe there is room in this city for all kinds of people, and we think a "new community" is an excellent mechanism for helping to assure that "all kinds" will live here.

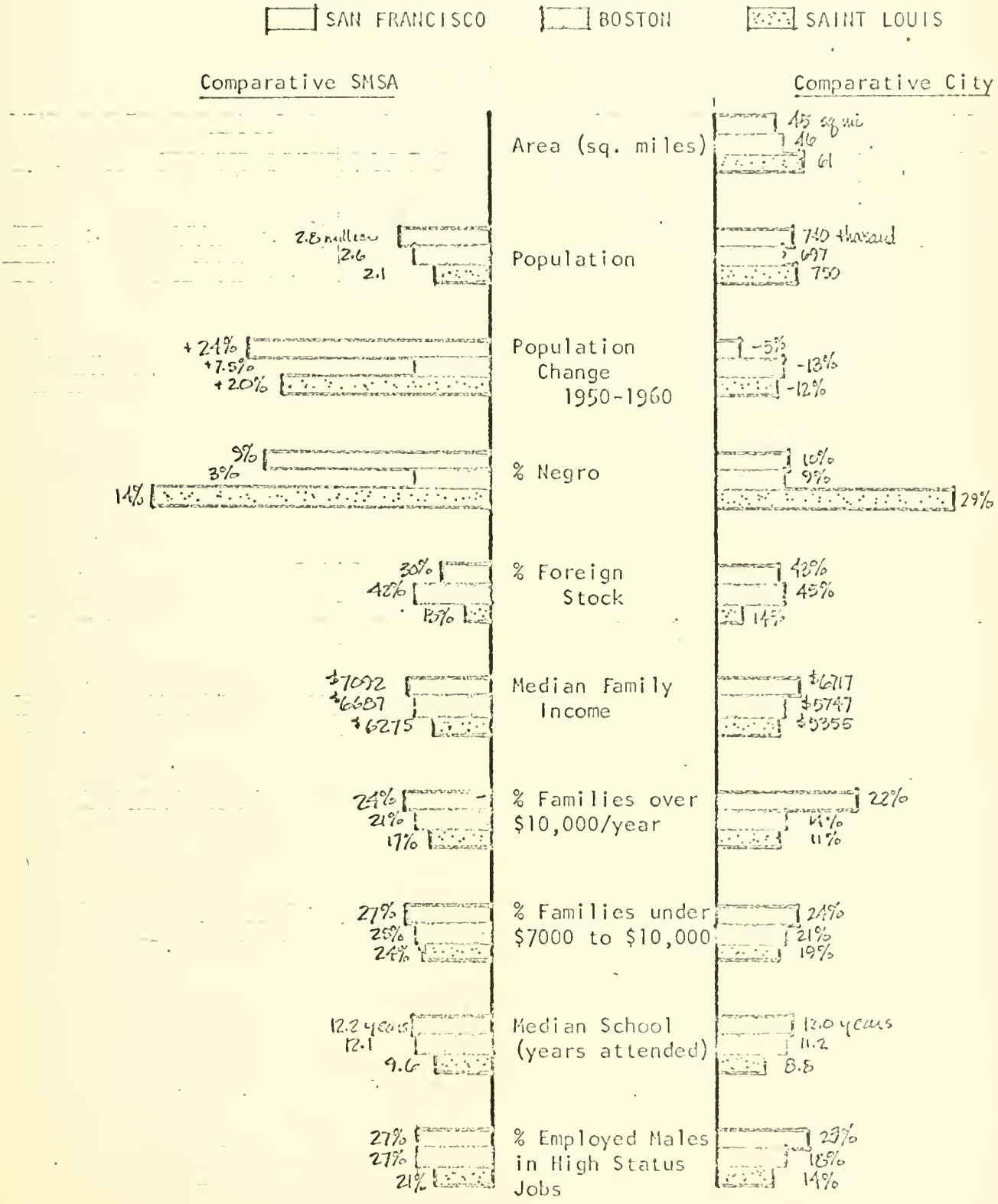
While it is probably too much to expect to attract many suburbanites back into town, a new community -- if properly designed and structured -- could provide a means of persuading some of those who would otherwise leave to stay in the city.

The disparity between city and suburb is demonstrated clearly by the 1960 census; there is every reason to believe that this difference has widened since then. Comparative data of two other cities (San Francisco and St. Louis) provide two different models of the direction in which Boston might go and are shown in Figure 1.

San Francisco and St. Louis are both cities of about the same size and population as Boston. San Francisco is the wealthiest SMSA (except Washington, D.C.) in the U.S. and the second wealthiest central city (after Seattle). Among the major cities, metropolitan St. Louis is one of the poorest in the U.S., Metropolitan Boston, which is the richest SMSA on the East Coast (except Wash. D.C.) is comparable to the San Francisco Bay Area. But, when one contrasts the central cities, the difference is striking. Boston now more closely resembles St. Louis.

Figure 1

1960 CENSUS COMPARATIVE DATA THREE CITIES



One of the major tools available to Boston to attempt to achieve a better balance is in the provision of new housing. The new community offers an opportunity to meet this challenge without sacrificing through urban renewal the interests and needs of the low-income people of the city.

RESIDENTIAL PATTERNS AND POLICY

Location

The Harbor site, in close proximity to the downtown core, will appeal to those employed in the core who do not wish to undertake long commuting trips from the suburbs. Few of the middle and upper middle income workers already established in the suburbs are expected to change residence for this reason; those still in the core city area will also be attracted by the new housing opportunities in the redevelopment of Beacon Hill and Back Bay. Moderate income employees may find the harbor a more attractive alternative, particularly those who are a part of the Boston institutional and governmental employment sector and for whom legal residence in the city is important. Upper income groups would be largely attracted by the amenities gained by proximity to the water, but the greater distance from traditional activity centers, in the downtown, Back Bay and Harvard Square areas, may be a disadvantage. Lower income groups, perhaps less concerned with the water amenity, can be expected to be more interested in proximity to job opportunities and traditional social activities.

Direct supply of lower and moderate income housing

The new community will not be large enough to meet the entire demand for lower and moderate income housing but it could provide a portion of this housing. This would widen the choice available in these markets, particularly in ownership units. In considering this need it is also important to avoid the creation of either a lower income ghetto or a racially unstable community.

Creation of relocation housing for families displaced by renewal

Some portions of older neighborhoods may be vacated for rehabilitation or renewal by relocating their residents in the harbor community. Some resistance to such a move might be avoided if the residents have anticipated the move for a period of time and have participated in the planning and development of their new neighborhood. It is more likely that relocation of families from individual substandard units will permit small scale upgrading or clearance. The development of new harbor housing could free a significant percentage of this substandard housing stock for renewal actions, thereby triggering a continual larger scale cycling of the relocation-renewal process.

Indirect supply of lower and moderate income housing through the"filter"process

The housing vacated by families moving into the harbor community would become available to groups further down the income scale. This theory, identified as the "filter-down" process says that: Families with enough money would move out of old but sound dwellings into new apartments; poorer families from old, unsound dwellings would replace them. This has often happened in Boston; the general changes in the housing stock imply as much. But there are several problems.

First, new apartments must be built for the same size of families that already live in the central city; for the most part new apartments constructed in recent years have tended to be small and unsuitable for children. In fact, developers and city officials alike often hoped the smaller, high-rise apartments would draw cosmopolitan adults into the city from elsewhere, rather than rehousing families already on hand.

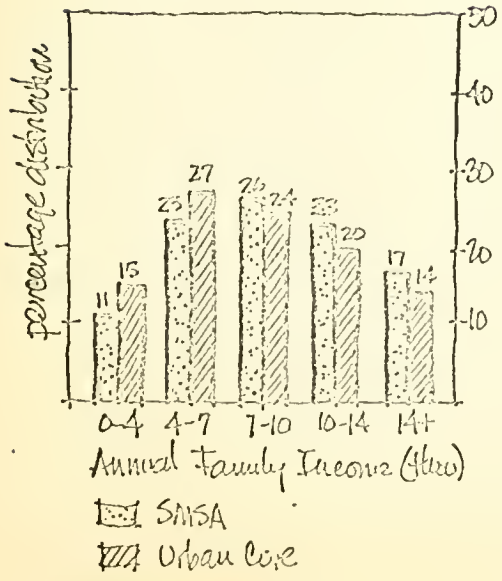
Second, the filter process has maintained or increased the gap in housing quality between rich and poor, whites and Negroes. The gains of Negroes were trivial when compared with the gains of whites.

Third, poor and black families bore the brunt of the tearing down which preceded the new building up. These people were often shunted from house to house; they frequently found themselves living in half-destroyed neighborhoods and they regularly ended up paying significantly more rent for only slightly better lodging. Within the context of new construction in Dorchester Bay, this particular problem is circumvented.

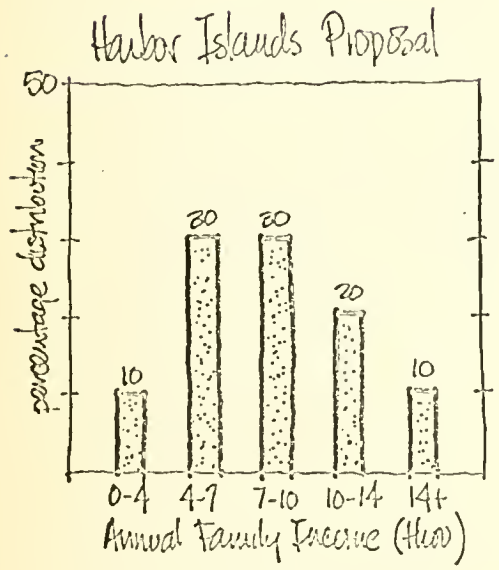
Thus, provision of middle-income housing in the Harbor can open up some new housing opportunities in the city for moderate income families. More importantly, the housing of moderate income groups in the harbor will create additional housing choices for the lower income groups within the city.

Alternate Socio-Economic Patterns

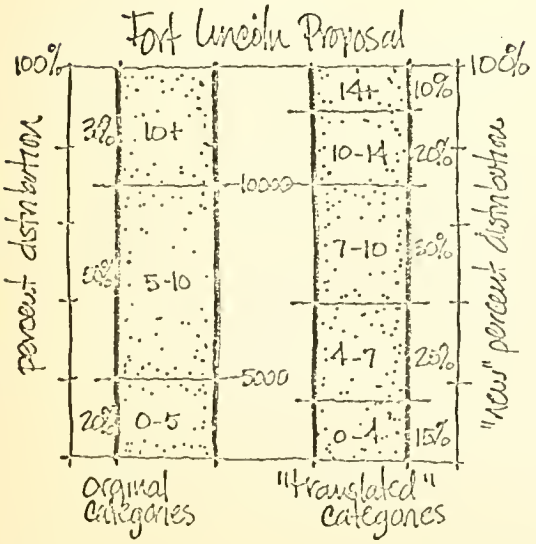
In order to set a comparative context for the discussion of possible socio-economic mixes for such a new community, it will be useful to compare income patterns for other communities. Both the metropolitan area (SMSA) and urban core (Boston, Cambridge, Somerville, Chelsea, Brookline, and Everett) will serve as useful reference points. Data collected in 1968 by the FHA, is graphed to show the distribution of households according to five categories of family income. These categories correspond to income groupings usually described as lower, lower middle, middle, upper middle, and upper income; this classification will be retained for later analysis.



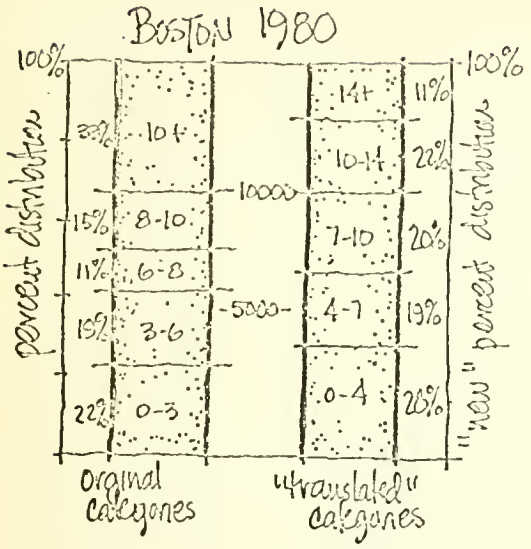
Experience to date with the planning and building of new communities has seldom confronted the issue of specific socio-economic mixes. The MIT Harbor Islands Report and the Fort Lincoln development in Washington, D.C., both of which are described below, are examples of socio-economic mixes that have been suggested; it should be emphasized that no one has yet attempted to establish a logical arguement for making such suggestions. It appears that this problem deserves very careful study in order to ensure that the mix finally chosen will result in a community that is economically, and socially, viable.



The MIT Harbor Islands Report proposes that if a new community is built its socio-economic distribution should closely parallel the existing pattern within the urban core but with a slight bias toward the middle income groups.



The Fort Lincoln development in Washington, D.C., represents the most advanced example of a "new town-in-town" currently being planned in the U.S. The proposal for Fort Lincoln recommends a 20% "lower" income, 50% "moderate" income and 30% "middle income distribution of families across the economic scale. These categories do not correspond to those used above. Assuming that these designations refer to "lower" as 0 to $5000, "moderate as $5000 to $10,000 and "middle" as above $10,000 they might be "translated" into the five categories we have used.



The MAPC has made projections of income distribution in Boston for 1980. Their income categories must also be translated for comparative purposes. All of these income distributions are graphed for comparative purposes in Figure 2.

In comparing the various income distributions in Figure 2, some sense of pattern emerges. Figure 3, however, reveals an entirely different pattern. Here, the less affluent neighborhoods within the City of Boston form the basis for comparative study. Included in this graph is a proposal suggested by the BRA ("Preliminary Analysis of the Housing and Demographic Components of the New Community").

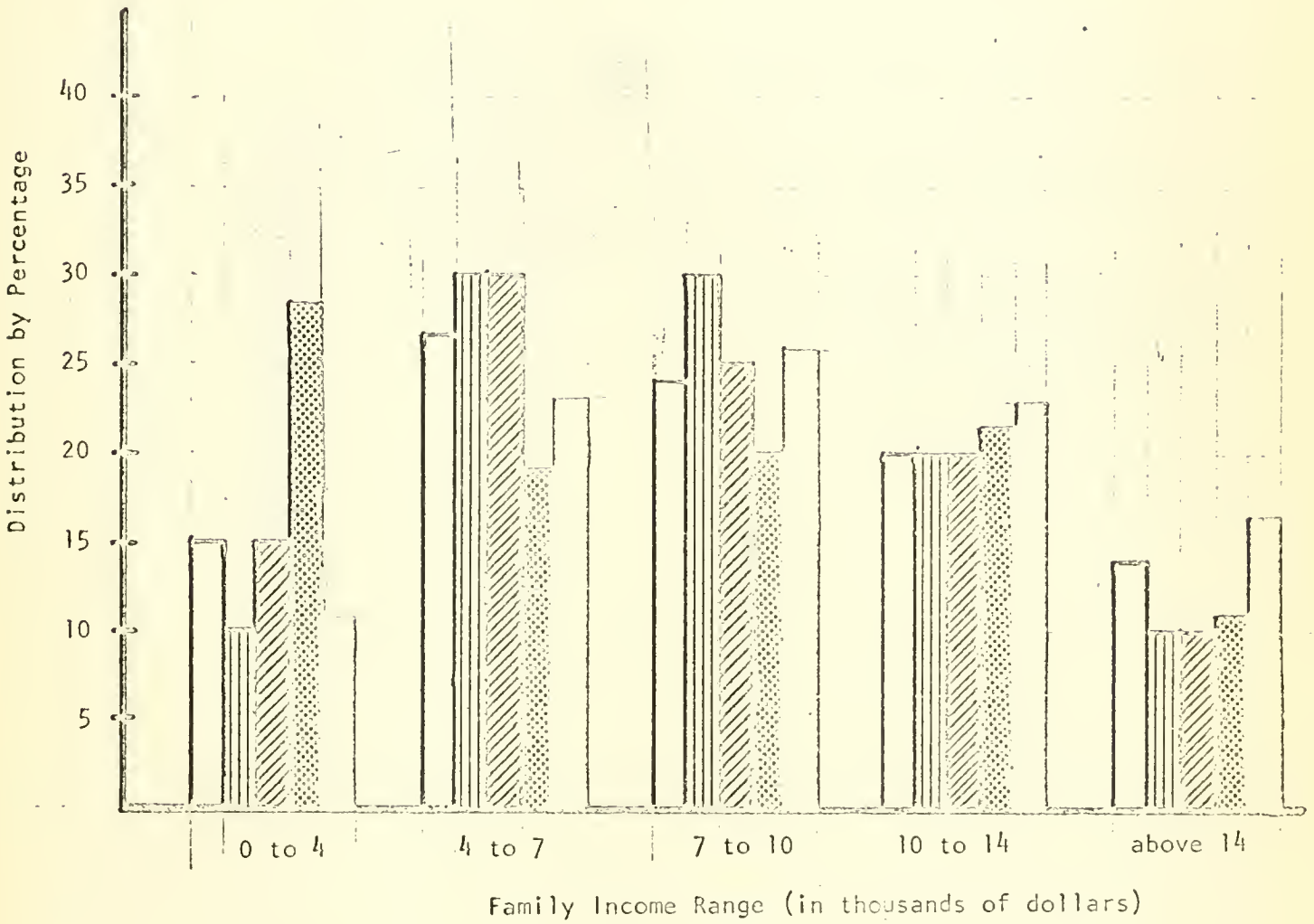
Residential Groupings

The preference for home ownership among moderate and middle income families, as well as some lower income families, suggests the creation of some predominately "ownership" neighborhoods within a larger harbor community in order to satisfy this demand. Experience has shown that at these lower income levels it is difficult to promote a satisfactory racial, ethnic or cultural mixing; neighborhoods tend to become relatively homogeneous. (Suttles, Social Order of the Slum.)

Higher income levels tend to display a preference for economic homogeneity rather than ethnic or class homogeneity. Rental and condominium apartments are considered much more acceptable to higher income groups, since families and individuals at this level are normally more mobile.

COMPARATIVE INCOME DISTRIBUTION

Figure 2

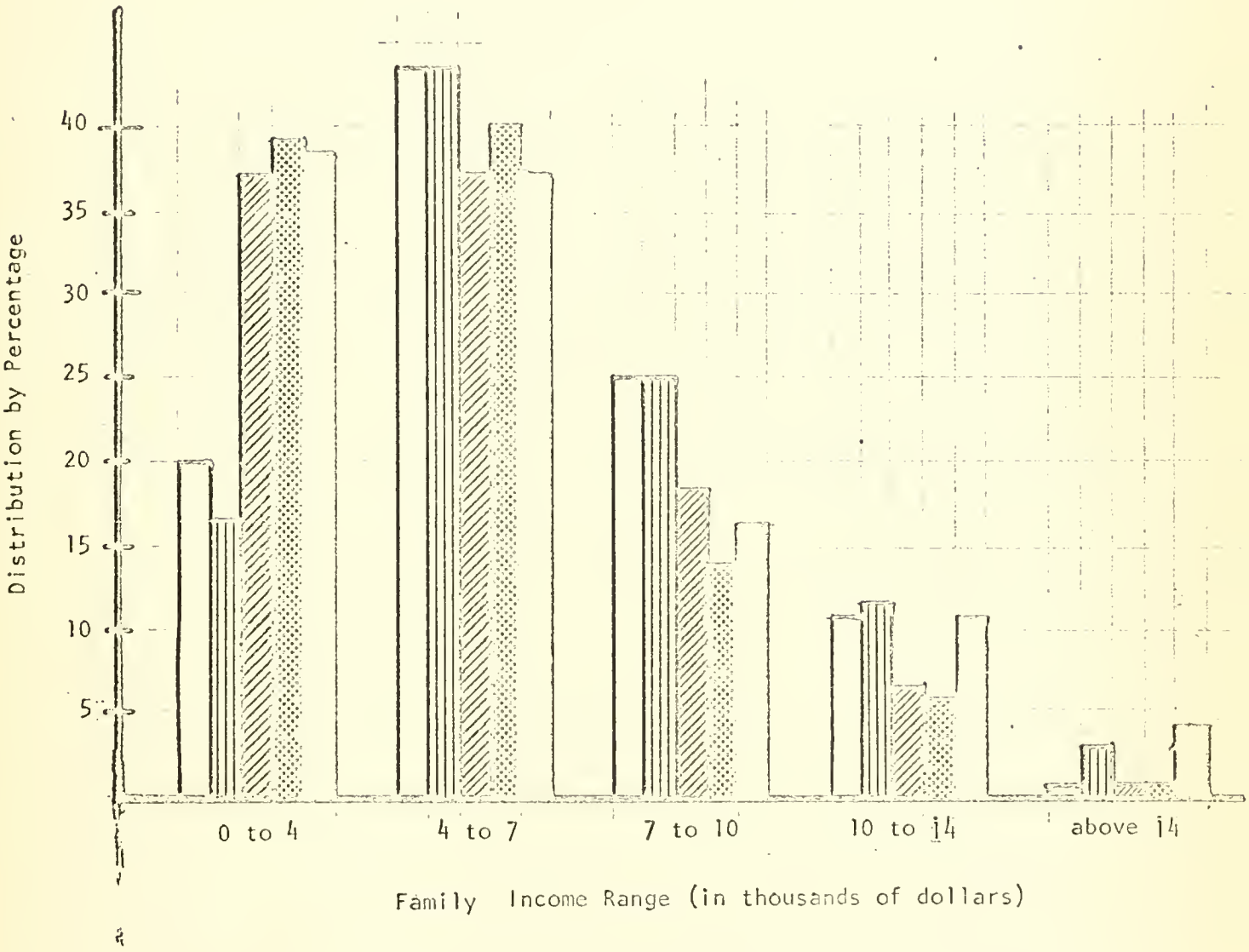


	0 to 4	4 to 7	7 to 10	10 to 14	above 14
URBAN CORE 1968	15%	27%	24%	20%	14%
HARBOR ISLANDS	10%	30%	30%	20%	10%
FORT LINCOLN	15%	30%	25%	20%	10%
BOSTON 1980	28%	19%	20%	22%	11%
BOSTON SMSA 1968	11%	23%	26%	23%	17%

Figure 3

COMPARATIVE NEIGHBORHOOD INCOME DISTRIBUTION

(1960 Census data)



	0 to 4	4 to 7	7 to 10	10 to 14	above 14
SOUTH BOSTON	20%	43%	25%	10%	2%
NORTH DORCHESTER	17%	43%	25%	11%	4%
ROXBURY	37%	37%	19%	6%	1%
NORTH END	39%	40%	14%	6%	1%
BRA PROPOSAL	38%	37%	12%	10%	5%

The need for both ownership and rental neighborhoods raises many questions. The following material discusses these basic differences between residential patterns in greater detail; it is taken from an analysis for the Harbor Islands Report, Prof. David Austin, an urban social planner teaching at Brandeis University.

Residential Issues

The issues involved in a housing-community mix include:

--Density of land use
--Grouping of residential units
--The mix of household incomes
--The mix of cultural backgrounds (ethnic, religious and racial)
--Ownership patterns

Range of Alternatives

The range of reasonable housing mixes can be illustrated by describing and comparing two extreme alternatives.

Alternative I is characterized by low density land use, owner occupied dwellings, ethnic-cultural homogenity and relatively small residential neighborhood groupings of 1000 to 4000 households. There would need to be several large common facilities serving such separate groupings, outside of any single neighborhood, such as a central shopping center and educational park including a high school, technical education, and elements of a community college. Medium-sized and small recreational areas would be adjacent to the residential groupings and controlled by local residents.

Alternative II is characterized by high-density land use, a predominance of rental units, and ethnic-cultural heterogenity, all within a single, large concentration of housing. Common facilities would be adjacent to and intermixed with residential groupings. Both large recreation facilities open to the public and small facilities that are private and limited to members would be included.

Some of the consequences and considerations which distinguish Alternative I and Alternative II are shown in Table 1.

TABLE 1

ISSUE	ALTERNATIVE I	ALTERNATIVE II
Ethnic-cultural population mix	Largely segregated	Largely integrated
Contact with diverse cultural patterns	Limited	Maximized
Effect on continuity of diverse cultural patterns	Maintain cultural diversity	Promote assimilation
Ratio of owner maintenance of housing to staff maintenance of housing.	High propotion of owner maintenance	High proportion of employed staff maintenance.
Control of behavior in public areas	High ratio of control thru informal social controls and sanctions	High ratio control thru formal rules an police surveillance.
Pattern of recreational facilities	small, decentralized facilities controlled by neighbors and largely without employed personnel on regular basis	Large central facilities with diverse resources open to all residents and with high level of employed staff for supervision and orga ization recreational activities.
Public school pattern	Small local lower level schools with central high school and post-high school facilities.	Medium large facilit at all grade levels adjacent to or inte-grated into housing concentration
Church pattern	Small units reflecting cultural groupings	Larger central facil ities for major religious groupings ethnic and cultural integration in the membership.

TABLE 1 (cont)

Land used for common community services	The ratio of land use for common services may be roughly similar in the two development patterns. In the low density development there may be more service facilities on a decentralized basis but more family service activities may also take place in private homes. In high density development there may be a more specialized development of service facilities. It is not clear if land use for service facilities should be concentrated in intensity to the same extent that dwelling units can be concentrated, for example, multi-story schools	
Relation to housing market preferences	Preferred by families with school age children and some older households with strong attachments to traditional ethnic backgrounds	Preferred by some older households, by young adults married and unmarried and by some families with children whose interests are diverse and cosmopolitan
Patterns of local retail and service employment	Employment within small local and residential areas with adjacent retail service would be primarily controlled by and draw from local families in area.	Employment in retail and service activitie could be more formall controlled at central locations and use a more impartial selection process assuring a greater degree of ethnic integration in the employed group
Implication for pattern of development	1. could include small developers or cooperative groups from various neighborhoods and ethnic areas in Boston. 2. Some development handled thru public agencies including units of subsidized housing. 3. Could include both large and small retail developers.	1. Primarily develope thru large housing developer with retail developer combined. 2. Some development directly under the auspices of public agencies for communit facilities and units of subsidized housing

A "Compromise" Community

For comparative purposes, let us describe a compromise between these two alternatives. We emphasize that this compromise is not a recommendation at this stage. We have described it in concrete terms, however, in order to point out some of the major areas in which further study is needed to define the goals of the community and find the best ways to attain those goals in the planning of the new community.

The creation of a new community that combined the best aspects of the issues identified in Table I would represent neither extreme but rather a mix of patterns suggested in Alternative I and Alternative II. This community would include some small (1,000-4,000 units), relatively self-contained neighborhoods with garden apartments or row houses, primarily for a lower middle income housing market. Each of these areas might be expected to develop so that it is ethnically and culturally relatively homogeneous. They should include a mixture of owner-occupied and rental properties, perhaps on a 50-50 basis. There should be provision for large families. There should be no administrative ceiling on the level of household income which is possible for families once they have moved into the area. Re-sale might be controlled in terms of preference to lower income families. Preference should be given to small developers from different parts of Boston, including the black community, in the planning and developing of such areas. Possibly a minimum of three and maximum of five such areas could be considered.

One or two larger housing concentrations (3000-7000) units), designed primarily for middle income households with a limited number of units for unusually large families and a limited number of units designed for rent supplements for lower income households. These housing concentrations should be developed and administered specifically to maximize ethnic and religious integration both in the complex as a whole and in individual units. This might involve some variety in densities but in general would be a medium density development. There would be a mixture of owner occupied and rental units but with a predominance of owner occupied units, possibly including cooperative or condominium development.

A limited number of units in high density development might be built near central activity locations such as a major shopping center or a major educational and institutional center. These units would be largely rental and would be designed for a mix of older couples without children and for younger families and single young adults. These should also include a limited proportion of units which are subsidized so as to provide some opportunity for low income households at both ends of the age spectrum to be included. Close access to public transit for these units would be important in order to permit access by both age groups to facilities in other parts of the city without requiring an automobile.

Housing development should be associated with three other forms of development:

1. New industrial development, which is compatible with maintaining an attractive housing area but which could provide both low-skill entry employment (with opportunities of upgrading skills thru on-the-job experience) and semi-skilled and technical positions, that would complement the specialized post-high-school and vocational high school training programs described below. This employment should also provide some opportunities for part time and full time employment for women.

2. An educational complex serving this community but with some services for a larger population, with an emphasis on a strong comprehensive high school and a variety of post-high-school programs both general and technical. The University of Massachusetts would provide both additional access for educational opportunities and additional employment in staff and maintenance positions for the resident population.

3. A network of community services and facilities which would support family and community patterns and provide opportunities for experimentation in organization, management and operation. This could include locally controlled school units, organizations for cultural and recreational activities, and group-practice, pre-payment programs covering a variety of professional type services.

Alternative Social Mixes Based upon the discussion thus far, several models of possible social mixes for a new harbor community offer themselves.

Model 1 -- This model (suggested in the BRA paper "Preliminary Analysis of the Housing and Demographic Components of the New Community") is an approximation of the economic mix of such neighborhoods in Boston as Roxbury and the North End. (See Figure 3)

The principal virtue of such a model is, of course, that we would be meeting, in a significant fashion, some of the most pressing housing needs present in the city, those of the lowest income categories, and particularly of Negroes. In the BRA model, 75% of the residents of such a harbor community would be lower and moderate income families. This would account for about 11,000 to 12,000 units out of a total estimated demand by 1980 of 34,000 low-cost housing units. The new community, though meeting only a third of this demand, would contribute greatly toward meeting the need for subsidized low-cost housing.

The question that is raised, however, concerns the social "workability" of such an income mix, as measured against the community need for diversity and stability. The median income of the proposed new community more closely mirrors that of Roxbury or the North End rather than the city as a whole. Such a community may not become a viable part of the city and may eventually become another black or lower income ghetto.

Model 2 -- This model is suggested by the predicted 1980 distribution of income of the city of Boston, that existing in the urban core today, and that proposed in Harvard's Study of a new town. This distribution would, in effect, create a microcosm of the larger city. While it would provide a substantial inventory of new housing for lower income people, and thus help in solving the city's major housing problems, it would not be predominately a lower income community. Such a new community would offer an opportunity for persons occupying apartments at the lower end of the rental scale to move into better housing within the same community as they become more affluent, without leaving their friends and neighbors. We believe that such a distribution of rent levels would find a market largely from within the present population of the city of Boston. Further, we suggest that the "filtering process of housing" would have an opportunity to work on a fairly large scale, to the point where a significant number of lower-income families would be able to find housing within the city, now occupied by somewhat higher income groups who would leave it for that made available in the harbor community.

Model 3 -- This model suggests the profile of an affluent suburb with a small lower-income population. Its main effect on the city, of course, would be to significantly enlarge the city's higher income groups overall, and, very likely, the city tax base. It relies heavily on being able to alter the present market trends for high income people, by luring them from the suburbs into an entirely new

life-style. This might be made easier by the substantial numbers of "their own kind" who would be present once a threshhold population was achieved.

Direction

The development of these models along with the analysis which preceeds them seems to be a useful direction for further investigation. The exact nature of the next step is difficult to define; even conclusions from the work thus far are not yet clear. This represents only a begining and, as such, must wait for final judgement.

INSTITUTIONAL STRUCTURE FOR THE NEW COMMUNITY

Introduction

If the decision is made to establish a new community in the Dorchester Bay area, the city will be confronted with the need to consider a number of questions relating to institutions, both within the new community and between the community and the city at large. In our view, these decisions are of a level of importance equal to the decisions regarding the physical design of the community in determining the character of the new community. The choices open range all the way from total autonomy (i.e., the creation of a new municipality) to a total merger with the city (i.e., no special arrangements).

If the decision is made to build the new community as a part of the city of Boston, both the physical planning decisions and the decisions concerning institutions can have the effect of giving the new community a sense of identity and distinctiveness, comparable to that already present in many other neighborhoods in the city.

There is a widespread view, backed by considerable research, that big cities generate a high level of alienation among their citizens, (see for example, Levin, The Alienated Voter: Politics in Boston, New York: Holt, Rinehart and Wilson. 1962.) often attributed to a lack of participation in the decision-making process. Negro riots, low voting levels among urban residents, and widespread demands for "community control" are current manifestations of this problem. These facts suggest the desirability of establishing in any new community some types of participatory institutions which will give to its residents a stake in the decisions made for it.

The creation of such institutions, in order to be meaningful, requires that the relationship between the new community and the parent city be somewhat different than that which now exists between the city and its present districts. These districts do not even have representation in the Council much less local decision-making power.

The process of building a new community will require the creation of some special institutional arrangements, whether or not a world's fair precedes it in Dorchester Bay. The range of possibilities here is substantial, both as to form and the locus of control.

Whatever arrangements are established for the construction phase of the new community, it will be necessary to produce a plan for the transition from a construction project to a live community. If "participation" by residents is to be a meaningful concept, some arrangements will have to be made to provide for such participation during the construction phase and before.

Most of these decisions will have to be made largely on the basis of normative and pragmatic considerations since there has been literally no experience quite comparable to this conception anywhere in the United States to provide The Community's planners with guidance and example.

The following sections will discuss these questions in more detail, will suggest what appear at this writing to be reasonable alternatives, and will indicate the directions in which further research is required.

Autonomy vs. Merger

Obviously, the best way to insure a high degree of participation in the local decision-making process would be to give to the new community municipal status. The size about which the BRA is currently developing its plans, 60-75,000, is comparable to and larger than the size of many of the towns and cities of the greater Boston region. With full autonomy the new community could solve its problems as it chooses without concern for the needs and interests of Boston's political leadership.

Against these supposed advantages, there are a number of disadvantages, however. The new community, as we have suggested above, provides an opportunity to the city of Boston to alleviate if not solve some of its more difficult social and economic problems. If the community were given municipal status, it would develop (no doubt, immediately) its own independent political leadership, obligated by the very nature of the jurisdiction to work for the benefit of the community, regardless of the effects upon other communities. This will not be helpful to Boston. Furthermore, the urban region, struggling to achieve some sort of rational and responsible regional decision-making process, hardly needs another independent suburb.

Perhaps as important as any of these reasons, however, is the following: the creation of the new community offers to Boston the unique opportunity to demonstrate to all the nation's cities (as well as to its own existing neighborhoods) ways of making urban government workable and meaningful to its residents. Just as the community will be an "experimental city" for design purposes, so can it be for institutional purposes. The creation of yet another suburb would demonstrate little that we don't already know.

While it may be tempting to the city to choose total merger for the first reason cited (a means of solving or helping with the city's problems), a great opportunity will be lost if the last reason is not placed foremost in the consideration. New participatory institutions will generate political opposition from some quarters undoubtedly, but the absence of an existing resident population and existing political leaders with a stake in the particular area argues well for new innovations if political leadership in Boston is committed to the idea.

A Sense of Identity and Community

For a variety of historic, ethnic, architectural, social, and other reasons, many if not most of Boston's neighborhoods have a high degree of distinctiveness. These have developed and been carefully nurtured for decades; in some cases, for centuries. It is the separate identity of these sub-communities that give to Boston itself a special character, making it distinctive among its sister cities.

While such distinct neighborhoods may engender some degree of parochialism, they also instill among their residents a sense of belonging and pride. The tenacity with which the "Southie" defends his area, the fervor with which the Beacon Hill resident has historically fought off commercial invasion, the vigor with which North End leadership has fought "redevelopment" and other "improvements" in his neighborhood are evidence enough of these strong feelings of loyalty. It is not the lack of interest in the community that brings on alienation in these neighborhoods; it is the sense of frustration at being unable to "move" the remote city government to provide the necessary care and services for these neighborhoods.

In creating a new community, it seems appropriate to consider ways in which this sense of identity and community can be developed more or less artificially and quickly; it is also desirable to consider the means of avoiding the effects felt in other parts of the city from the historic process of centralization.

One approach which we propose to follow is to perform an analysis of governmental functions, and determine which functions can most reasonably and logically be delegated to the sub-community, which should be retained by the central government because of the necessities of economy of scale, and which should be shared in some way or another. (See below for an illustrative list)

One obvious possibility for the final community is to establish some form of representative body which would be given the first group of responsibilities, and to which the residents of the community would go for all types of inquiries and demands, i.e., A government close to and responsive to the people, which would be understandable to the people.

The internal structure of the community will depend on the nature of the physical design. There is little question that low-income residents in large cities define their "turf" to encompass a very small urban area. (See, for example, Suttles, The Social Order of the Slum, Chicago: U. of Chicago Press, 1968; Gans, The Urban Villager, New York: Free Press of Glencoe, 1962; Elliot, Talley's Corner, Boston: Little, Brown, 1967.) Also, studies of public

housing projects (See, for example, work by Lee Rainwater) suggest that the absence of definable spaces in these areas leads to a lack of sense of identity and responsibility. Such studies suggest to us that clear-cut, small neighborhoods, separated by non-residential functions (parks, shopping areas, etc.), are likely to be the best physical answer to the quest for community. If such is the decision, local institutional structures should follow this physical design. If the design is otherwise, it places a greater burden on the institutions to, themselves, define the subcommunities. A community of 60,000 is obviously too large to serve as the major source of identity for the majority of its residents.

Relationships to Boston

We have already suggested the need for some sort of special arrangements between the new community and the parent city in order to engender a sense of identity and community on the part of the new districts' residents. And, in Section II of this report, we described the highly centralized nature of the Boston city government. The identified need and the present degree of centralization are grossly inconsistent.

The city's political leadership is under some pressure from a number of quarters to alter this degree of centralization. There are, of course, the demands from the Negro community of Roxbury for greater control over their own destiny. And, to some limited degree they have already achieved it

in that portion of their community encompassed by the Model Cities area. There are also heard, from time to time, demands for a restoration of the system of electing councilmen from wards in order to gain some degree of "representation" for all areas of the city. Thus, it may be, by the time the new community becomes a living organism, that there will be a different pattern existing in the city. If so, it may not be necessary to develop anything particularly radical for the new community. If not, some special arrangements will have to be made, which will undoubtedly cause some political opposition.

The Special Problem of the Schools

This governmental function requires special comment. There is little question but that the success of the proposed new community in attracting residents will be heavily dependent upon the quality of the educational system. A community of 60-75,000 can obviously support a full school system and perhaps even a community college. Since the new community is expected to attract a wide diversity of economic and social classes, it is apparent that the educational system must be designed with great care so that it will be acceptable to all groups. A basic requirement appears that the school system be innovative. It must seek new ways of reaching children to whom school has not been a meaningful experience and provide a high quality of education for everyone. It will also serve as an important mechanism for teaching its charges how to get along with each other, and for giving to them an appreciation not only of their own cultural heritage, but also of others represented in the local community.

Another requirement is that the policies of the educational system of the community be subject to strong inputs by the members of the community. There must be a high level of community participation and, for some types of policies at least, there must be community control. It is well demonstrated in many, if not all, large cities that it is very difficult to achieve flexibility, to allow for rapid change when the situation calls for it, to provide for special programs demanded by the peculiar circumstances of a neighborhood unless the local community is highly involved. This school system must be a demonstration to the Nation of the ways in which a big city school system can be responsive to local need, can be innovative, and can be of high qualtiy.

Several possible means of achieving these basic objectives present themselves. The first might be a special demonstration program of the Boston school committee, in which an agreement is reached between the Committee and the local community providing for a maximum degree of autonomy along with a high degree of technical assistance from the present school system, augmented, no doubt, by programs developed by the Boston-area graduate school of education. The second possibility would be to form a contractual arrangement with the State Board of Education, in which the latter would provide the technical direction under the policy guidance of the community's duly elected representatives. A third possibility, which could be handled in consort with either of the other two, might be to ask the Graduate School of U. Mass. at Columbia Point to assume primary responsibility for technical advice, for teacher recruitment, etc., for the school system.

The Fair offers some additional potential opportunities, for the educational system, if it materializes. Presumably, educational innovation will be a major theme of the Fair. If this is the case, it will be possible to attract many commercial exhibitors who are in the education business amd who might even establish an experimental school at the Fair, which could continue afterwards. Whichever of these approaches may be used, we wish to emphasize again the need for responsiveness to the local community and the complementary requirement for meaningful participation in decision-making.

The Development Corporation and the Transition to Community

Regardless of whether or not a fair is built in Dorchester Bay prior to establishment of the new Community, it will be necessary to create some sort of special institution to develop the site and carry out the plan.

For this policy decision, we have some experience to draw upon. Most of the recent world's fairs and most "new towns", both in the U.S. and abroad, have used the device of a special corporation to carry out the job. It seems likely that this device will be the logical one for the Boston program, as well. It offers a degree of flexibility and freedom from the usual restrictions governing normal public agencies that make its use almost mandatory in this area.

We have not yet had an opportunity to study these instrumentalities as they have been used elsewhere, but we intend to look into this question in depth, both as to its financial and administrative implications and its use as an instrument of political control.

In the latter respect, the development corporation may offer an interesting opportunity to the city to meet the needs for some degree of autonomy within the city political and governmental structure. It may well be possible to retain the corporation after the community has been occupied and use it as a device for the conduct of certain public services. It will have to be agreed in advance that the original directors of the corporation (appointed for its development phase) will be systematically replaced by representatives of the community.

This raises the interesting question of who the directors of the corporation should be during the development phase. An MIT planning course in the Fall semester 1968, considered a similar question and concluded that, in effect, "surrogates" for the ultimate residents should be appointed as directors. By this, they meant that persons whould be selected who are empathetic with and who could be expected to speak for the eventual residents of the new community.

The question is an important one because most of the significant planning decisions will be made during the development phase, and would otherwise pre-empt these important decisions from the ultimate residents. Once residents begin to move into the community, when the first phase of new housing is completed, then the replacement of director by community-elected officials should begin. Since the Columbia Point housing project will presumably be a part of the new community, it may also be desirable to draw an original member or two of the Board of Directors from that source. During the transitional period, after some residents have been selected as Board members, it would seem desirable to assure that the Board will be representative throughout of the ultimate population.

A number of "new towns", particularly abroad, have been through this transitional process from appointed corporation to elected community government. We will study further the experience of these towns to see if there is any applicability to the Boston new community.

Previous Experiences

The new community in Dorchester Bay will be a "first" of its type. To our knowledge, there have been no comparable schemes developed anywhere in the world, certainly not in the United States. The most comparable plans in the U.S. are the proposal for a new community in Washington on the present site of Fort Lincoln. There is some discussion of a similar development -- also at an unused military installation -- in San Francisco. There have, of course, also been discussions in New York of establishing a so called "Linear City" in Brooklyn. None of these have gone beyond the talking stage, we understand, but we intend to research all available materials on these proposals.

In Europe, the most comparable projects are found in Holland, some even in the "action" stage. They are particularly of interest because of their use of water and dependence of land-fill. Otherwise, we know of no major "new communities" within existing European cities. Although many bombed out cities had a golden opportunity to create such a thing, the closest to it was Rotterdam, which rebuilt its commercial center and thus does not offer a scheme of comparable character. We will continue to research these possibilities, as well as the general literature of "new towns" in Europe which may offer some interesting insights for this scheme.

Although these European experiences may be of value for planning purposes, they are unlikely to offer much to us of use in designing institutions. Whatever institutions are proposed or developed for Boston's new community must be consistent with the traditional political systems of Massachusetts, even though there will be innovational departures from them in detail.

It appears at this point that the most valid experience on which we can draw for the design of institutions with some degree of autonomy but remaining within the city is in connection with contemporary model cities programs, anti-poverty boards, and schemes for community control of schools. A fair amount of experimentation is currently taking place all over the United States in connection with these programs, and there are lessons to be learned of what to do and what not to do along these lines. Indeed, there is already beginning to develop some literature on the subject, which we will explore in greater detail.

Subjects for Further Research

Our comments above are, of course, highly preliminary and very general. Our effort to date has largely been to make a preliminary analysis of the existing literature, to offer some tentative comments on the nature of the problem and to identify the areas where further research is needed. In this general question of institutions, we feel further research should be directed toward the following subjects:

(1) neighborhood participatory institutions in U.S. cities.

(2) the social structure of low-income communities, attitudes toward city government, alienation, "world-view", etc.

(3) institutional arrangements in U.S. and foreign "new towns"

(4) private and public development corporations in new towns, devices for transition from construction to self-government; also, corporation for world's fairs; including financing provisions.

(5) literature on "community", "identity", etc.

(6) Ethnic assimilation, behavior of and interaction of ethnic groups in American life

(7) Urban education

(8) functions of government, and how they might be distributed between parent city and sub-community. Given the present distribution of public functions in the metropolitan Boston area, the following table is suggestive of how they might be distributed among: (a) the new community, (b) the City of Boston, (c) higher authority. (xx = primary authority; + = secondary authority.)

Function	New Community	Boston	Higher Authority
Police	+	xx	
Fire	+	xx	
Water		+	xx
Sewerage		+	xx
Public Transit		+	xx
Highways		+	xx
Street repair	+	xx	xx
Street cleaning, snow removal		xx	
Parks	xx	+	
Recreation	xx	+	
Plannign & Zoning	xx	+	
Library services	xx	+	
Community centers	xx		
Health Centers	xx	+	
Education	xx	+	
Adult education	xx	+	
Air and Water Pollution			xx
Public Welfare			xx

ECONOMIC BASE

The New Community will not succeed in solving many economic and employment problems which confront Boston. The scale of the more significant problems precludes the possibility that a community of limited size will make such a sweeping contribution. However, the New Community, if utilized as an urban laboratory, could relieve the severity of many of these problems, point the way to dealing with these problems in the future, and suggest imaginative means of dealing with urban development as a tool in the solution of these problems

Relocation Needs

In the case of the small retail establishments dislocated by public action, the new community could conceivably serve as a partial remedy to the relocation problem. The New Community will include many retail and service establishments to serve the local residents. A relocated business could thus enter a neighborhood atmosphere where it would not have the added burden of competing with established patronage patterns. A more definite determination on the validity of this assumption will have to wait until research has been conducted into the various marketing patterns and the competition which is likely to develop as a result of the social mix in the New Community. It is possible that many of these small retail and service businesses are no longer economically viable because of increased urban mobility and the expansion of business in a better competitive posture.

The New Community can also address itself to the problems of the larger businesses which are forced to move from the core as a result of there being insufficient land available in the core.

If plans for the New Community included about 3,000,000 square feet of light industry, large parcels of industrial land would be available to fulfill a very definite need. In addition, the New Community, Columbia Point, and other areas serviced by the MBTA, will provide a pool of skilled workers and unskilled workers. Undoubtedly, the firms most difficult to attract to the new location will be those that are large and sufficiently dependent on skilled labor that the suburban alternative will be more economical and probably more convenient for management and higher wage employees. If the amenities are sufficient to attract higher income groups to the New Community, and if commuting is easy enough, and if the physical plant is priced competitively with suburban locations, those firms requiring more skilled labor might be attracted to the new locations. This is a doubtful proposition.

The figures on future business relocations in Boston suggest some guidelines as to which firms should be attracted to the New Community. Three million square feet of land for light industry is a large quantity in Boston - but it will not go far in meeting relocation needs unless the most economic use of the area is made. Among the types of businesses being relocated, manufacturing appears to use the least space per employee. The most intensive use of the land in this respect will maximize its benefit to Boston and to the New Community. For the purpose of figuring the actual square footage per worker in a manufacturing firm in the New Community, the 350 square feet per worker figure common among the relocating firms is not accurate. It is fair to assume that most of

these businesses have been long established and are rather cramped for space. In addition, more modern plants require more space if they are going to be pleasant places in which to work. Consequently, the areas in the New Community for light industry, if they are devoted to manufacturing (the most intensive use), could not yield more than 5,000 jobs.

The New Community will not be able to absorb all relocated manufacturing establishments over any long period of time. Nor are many of these manufacturing establishments amenable to the New Community. Since industries will have to be located close to residential structures in the New Community, nuisance industries should not be located there. The Metropolitan Area Planning Council identifies "electrical machinery, printing and publishing, instruments, miscellaneous business services, real estate, insurance and private education" as industries exhibiting "significant rates of growth". All of these could be located in the New Community very comfortably. All of these are also dependent on skilled labor. Consequently, some effort will have to be made to attract industry which utilizes unskilled labor.

The garment industry, for example, utilizes unskilled labor, and many garment manufacturers are being dislocated. Another characteristic of this industry is that it is highly dependent on low wage rates and this is a central consideration in plant location. Thus, it is probable that a dislocated company, or a company finding itself inaccessible to low wage workers, would be attracted to the New Community if there is a pool of low income and unskilled workers. It should be noted, as a

matter of policy, that the New Community could be a vehicle for economic improvement for the residents and that to limit the industrial area to low wage industry would tend to limit these opportunities. The garment industry does present several attractive opportunities for the lower economic groups in the New Community context.

A 1966 study by the U. S. Department of Labor showed that 3/4 of the unemployed of Boston's slums were Negro. One half of the Negro unemployment was among women from 16-24 years of age. Many of these women were not available for work because they had to remain at home to care for children. With high quality child care centers which the New Community could provide and readily accessible jobs in the garment industry which lends itself to female employment, the New Community could fulfill a business need and a crucial employment need.

What is needed in the New Community is a variety of industry that caters to different levels of skill in their employment patterns. As an example, firms presently on the relocation rolls which could be relocated in the New Community might include Century Sportswear Co. which now uses 60,000 square feet and has 100 to 249 employees, Relief Printing which now uses 33,900 square feet and has 180 employees and Audiovox Corp. (manufacture hearing aids) which now uses 9,000 square feet and has 90 employees. The latter two industries both require moderate levels of skilled employees and might otherwise relocate outside of the city.

The New Community and Employment Problems.

To alleviate the employment problems summarized above several approaches can be taken. The lack of jobs available for unskilled workers can be increased by attracting businesses which employ unskilled workers to the city. This approach would not likely yield any success. Most firms which rely on unskilled labor would be more likely to relocate where costs are not as high as in Boston. The use of tax incentives might overcome this obstacle but the taxpayers' being already burdened with extremely high taxes and the city's increased financial demands make this alternative highly unlikely.

Aside from traditional labor negotiation, strikes and minimum wage legislation, there is no way to alter the very low wage structures in certain unskilled jobs. In many low-paying industries, the wage scale is such an important factor that higher wage demands could lead to relocation to an area where wage demands were not as great.

Thus, the most important approach to the employment problem appears to lie in upgrading the skill level of Boston's sub-employed residents. It is in the occupations requiring skills that there is a demand for workers -- and this demand is destined to grow with Boston's economic expansion in the technical fields. As Robert W. Eisenmenger reported:

> So far as public policy is concerned, this suggests that the future of Boston depends more on training a highly skilled labor force than it does on trying to compete with very low wage rates in the conventional mass procution industries. More favorably situated areas such as Chicago, Detroit, and Youngstown might conceivably be able to maintain high standards of living even without a substantial educational effort. In Boston, the emphasis must be on providing excellent training for a large number of people with diverse talents."

(Economic Development in the Boston Area, "The History and Structure of the Boston Economy", by Robert W. Eisenmenger, Joint Center for Urban Studies, 1965) p.7.

Among the unemployed covered by the 1966 survey, by most of the respondents expressed a willingness to take on job training or return to school for training if necessary. If the New Community can provide well financed and comprehensive programs for job training, through the University of Massachusetts or some other mechanism, a substantial contribution will have been made towards alleviating the employment problem of many of these slum residents.

Within the community, an innovative school system of superior quality might help reduce the number of drop-outs. With additional opportunities for high school students, such as part-time employment in the immediate vicinity, the drop-out rate could be reduced to a minimum. Reducing the school drop-out rate will be of increasing importance in the years ahead in order to provide needed skills.

Another reason for priority consideration to the problem of school drop-outs is demonstrated by unemployment statistics. The sub-employed have a low median educational attainment. Because of social and racial discrimination, and a background of poverty which often results in an early abandonment of school, this segment of the population is more likely to experience higher levels of employment and sub-employment. Providing the necessary educational opportunities to allow these people to compete in Boston's skilled labor market is of the utmost importance.

The impact of firms moving from the core to the suburbs can be most effectively reduced by providing the large parcels of land that these companies require at competitive prices. However, because of the scale of the problem it is unlikely that the New Community could make a perceptible dent in this trend. In light of the limited amount of land that could be made available for industry in the New Community, it is doubtful that major industry bound for Rt. 128 can be attracted to the New Community.

The New Community can also make a contribution, in terms of strengthening the regional economy. The location of the University of Massachusetts campus on Columbia Point will add to the research advantage provided in the region and may serve as an attraction to some firms. It should also be noted that Roger E. Bolton predicts that Boston could be an important center for the increased activity in oceanographic research because of its coastal location and research advantage. The Thompson Island location for such a research institute would definitely be a positive asset to Boston and the New Community.

Conclusions

Because of the scale of the employment problems and the breadth of some of the unfavorable trends in Boston, the New Community will be no panacea. The New Community can contribute substantially if it is viewed as experimental and prototypical.

In terms of business relocations, the New Community will probably aid some retail and service enterprises to relocate more adequately in the Community. However, the bulk of smaller dislocated businesses will experience the relocation problems they have traditionally faced.

The larger displaced business will find the New Community a satisfactory alternative to suburban locations if they would still be competitive in the market at the community location. Businesses dependent upon proximity to the central city unskilled labor pool and who therefore cannot leave the city are more likely canidates for a harbor location.

In the area of sub-employment, the New Community can also make a modest contribution. Once again, because of the size of the problem relative to the scale of the New Community, the role of this effort will be experimental and prototypical. The role of the Community in this respect will be to provide opportunities for improvement of occupational skills and certain job opportunities. Further research is needed to determine more precisely the range, and number of jobs generated by the Community and their geographic ability to attract workers.

Thus the New Community will be able to make important contributions in solving some of Boston's economic needs. However, it will be a contribution primarily by example. This is also true of the New Community's role in reversing the economic drift to the suburban ring -- it can create an exciting alternative for worker and employer alike.

COMMUNITY GOAL FORMULATION

In considering the possibility of a new harbor community, it is necessary at the onset to identify clearly what it is the city is setting out to accomplish, i.e., what would be the city's general goals in creating such a new entity? The selection of such goals, and the establishment of priorities among them are, of course, policy determinations which must be made at the highest levels. Our role -- as we see it -- is to identify several possible goals, to examine their compatability, and to point up the relative advantages and disadvantages of emphasizing each.

We see at least three major desirable goal alternatives for Boston in seeking to establish a new community in the harbor. In our view, all three can be met in part by a range of alternative approaches in the planning of the new community; the selection of the planning approach depends on the choice of goal priorities. Some other possible planning approaches would emphasize one or another of these goals to the almost total exclusion of the others.

The following are the major goal alternatives as we see them:

Goal 1

The new community might be viewed as a tool to meet certain objective needs of the city of Boston. Four major ones -- which such a development might help the city to tackle -- are evident: (a) the chronic housing shortage, particularly for low-rent

housing; (b) the high unemployment rates among certain groups in the community due in part to the absence of low-skill jobs in the city; (c) the fiscal "crisis" of the city and the extreme shortage of vacant land on which to build tax-paying properties; and (d) the difficulties of finding adequate relocation sites in Boston for families and businesses whose properties are to be taken by forthcoming urban development projects (e.g., urban renewal and highway construction).

Goal 2

The new community might also be seen as a means whereby the city can stem the currently strong trend toward movement of middle class families and certain types of industries and commercial activities out of the city to the peripheral suburban areas. A well-planned community, with amentities attractive to these potential occupants, might well offer an interesting alternative to suburban sites.

Goal 3

The new community might be viewed primarily as an "experiment" or "model" of new techniques in physical and social planning. The space available in the harbor area offers opportunities for developing a highly urban, planned community, totally different from anything in this country or abroad. It provides a chance for demonstrating that it is feasible for groups, both ethnically and economically heterogeneous, to live together compatibly.

The Choice Among Goals

Before discussing in detail the relevance of these goals to the city and to the planning for a new community, it is appropriate to identify our reasons for selecting these goals as the major choices facing the city, the problems of compatibility of the

three goals, and the implications for the city of emphasizing one over another.

The three goals are outgrowths of the situation in which Boston finds itself. While Boston's problems are not unique, they do have certain peculiar configurations, which limit the solutions available and which give Boston certain advantages over other cities. The three goals might be identified with three respective points of view: Goal 1 is likely to be emphasized if one is preoccupied with the immediate, internal problems of the city; Goal 2 if the center of attention is Boston's role in the metropolitan area as a whole; Goal 3 is related to and springs from a more visionary approach, in which one hopes for dramatic solutions of relevance to the whole American urban scene.

While the selection of each of the three goals has some obvious surface appeal, all three cannot be given equal priority, in our view. There are some built-in incompatibilities which will require the city to choose among the three in terms of priority. To some degree, as we will demonstrate the choice is not entirely free to the city; certain hard facts limit the opportunities available to the city.

With respect to Goal 1, our preliminary analysis indicates clearly that the new community cannot be a total solution to any single problem within the city. Land for any one of these uses- (residences, industry, commerce, recreation, etc.) will be highly limited; its use for diverse purposes can, however, partially meet significant numbers of them.

Beyond the mere question of space, there is the problem of appropriateness of the area for the established needs. It is doubtful that the area can offer all the kinds of housing desired by the groups in the city in need of better housing. Even more clear is the likelihood that the area cannot provide all the needs of the industries and commercial activities that the city is seeking to help.

The principal problem in the adoption of Goal 2 (stemming the movement of population, commerce, and industry to the suburbs) is its feasiblity. If this is chosen as a (or the) major objective, it will represent a reversal of existing "natural" trends within the metropolitan area. We have little evidence to suggest that any subcommunity within the city can be made sufficiently attractive to alter the present and very strong decentralization trend of both families and industrial/commercial activities in the area. While in theory the community can be designed and organized in such a way that the advantages of the suburbs can be equalled or bettered and the disadvantages of the city can be overcome, we will have to know a great deal more about what those advantages and disadvantages are before we can have any confidence that such a reversal is a practical objective.

Goal 3 obviously involves many unanswered and unanswerable questions. There is literally no example extant of such a new, planned community anywhere in the world, with the kinds of objectives being suggested in this goal. In the United States, "new

communities" that have gone beyond the planning stages are very few in number and (at present) are relatively homogeneous, both as to class and ethnicity. Abroad, there are a few socially heterogeneous "new towns" in Britain, Scandinavia, and elsewhere, but we have little empirical evidence of their social viability as "communities", and even if we did, there would be valid questions as to the cultural transferability of such findings to the United States. Furthermore, studies of group relations in the United States raise doubts about the transferability of data from one American region to another. One need hardly note that the likelihood of compatible neighborhood relations between whites and blacks in Boston is better than in Houston; but one might well have reason to expect that neighborhood compatibility between Irish-American and Italian-Americans would be less promising here than in some other cities in the United States where ethnicity is not such an important feature of the local culture.

If Goal 3 were selected as the primary goal this would limit the ability to meet Goal 1. The housing needs of the city are greatest for the lowest income groups; a viable "model" community of people of diverse social status and ethnic background will require emphasis on the kinds of facilities, both housing and urban amenities, demanded by higher income groups.

By similar token, the selection of Goal 1 as the over-riding goal will seriously limit the possibility of achieving goals. In addition to the previous point

a heavy concentration on lower income residences and jobs would raise the danger of creating a new ghetto, a result which is neither inherently desirable, nor one likely to attract the capital of public and private groups needed to make such a new community "go". The heavy concentration of minotity groups in low rent housing, and their unusually rapid growth in the city would cause the ghetoization of the community.

The major attraction of Goal 3 derives from a number of considerations. Many American thinkers, in and out of officialdom, are seriously concerned with the quality of life in the city, and are likely to be attracted to a large experiment that would offer the possibility of creating something new, an environment so different from anything that now exists that it offers real hop of achieving a new kinds of life in the city. The new harbor community is of sufficient size to offer this opportunity.

In a number of ways, Boston offers attrattive prospects for such an experiment. Its population is still very diverse; it has not yet been overwhelmed by black and Spanish-speaking migrants. While there remains in the city (and the metropolitan area) a relatively strong ethnic consciousness, the likelihood is that the pure "ethnic ghetto" (other than the black variety) is losing its viability; people are increasingly getting accustomed to living in close proximity to others of different background.

Furthermore, the city is one of the relative few in the U. S. in which there is a strong tradition of

urban living. The continued attraction of Beacon Hill and to some extent the Back Bay, the recent "rebirth" of the South End and Bay Village as middle class living environments, and the generally satisfactory rental experience of the new highrise apartments in the center of the city suggest that there is a strong market for higher cost inner-city living accommodations. In relatively few other American cities is such behaviour evident. It would seem to be explainable (in part) by a number of factors: (a) the actual or potential attractiveness of inner-city neighborhoods. (b) the presence of the aforementioned tradition of urban living, (c) the continued relative strength of the central business district as a shopping and recreational center, as well as a major business activity center, and (d) the presence in the metropolitan area of a large number of "urban intellectuals" and their followers who would be attracted to urban living no matter what city they lived in.

The creation of an imaginative "new community" might offer such people an alternative they do not now feel they have in the suburbs.

The present general direction of American cities is toward an increased concentration of minority groups (particularly blacks and Spanish-speaking) in blighted areas around the central business district, and the dispersion of the white middle class to the periphery. Whether the "periphery" represents independent suburbs or merely the outer fringe of the central city is simply the product of the age of the city. The older cities, particularly in the

North, tend to be small, and thus they lose their middle-classes to separate suburban municipalities. The newer cities, many of which have been able to annex major portions of "suburbia", do not actually experience the loss of these more affluent tax-payers and residents.

If this process continued indefinitely, the social implications of such increased segregation are formidable to consider. A number of possible policy changes or other changes in social attitudes, economic status, and the like, could conceivably change these trends eventually, but all will be slow in coming, if they come at all. A new community of substantial size could well be a means of demonstrating to the cities of the Nation the means by which these trends may be reversed or seriously slowed.

5 DEVELOPMENT STRATEGIES

Alternatives

The development of a new community will require a tremendous expenditure of resources. Before such an undertaking can be justified, or even seriously considered, an intensive cost-benefit analysis must be conducted. It is reasonable, however, to assume that the City of Boston could not finance such a project by itself; large sources of Federal and State funds would be required to augment the city's investment. Therefore, the new community must be organized in a way to insure that such funds will become available.

One strategy that has been suggested for attracting outside funds is the creation of a World's Fair on the site, followed by the new community development which would utilize the physical infrastructure.

A proposal to this effect has already been made public. Since the requirements for a community and for a fair are not entirely compatible, it is necessary to examine closely the degree of fit, or misfit, and to take actions in planning the Fair which will not adversely affect the future viability of the community. Some preliminary work on this area, concerning transportation, has been started and is included in this report.

Another approach would be to use the Dorchester Bay site to create a new "National Prototype City". Such a new community would be constructed as a national effort; the participation of large industrial corporations in the research and development phases might be encouraged. A great deal of support would

be required, analogous to the degree of Federal backing which the space program received. This project would be an experiment which would bring together the most innovative techniques in planning and management as well as innovations in technology.

It is possible that the Federal Government may not choose to put all of its resources into a single project, but rather to construct a series of "new towns" across the country. Such a development would be similar in most respects to the development of a national prototype city except that the degree of national involvement and participation in this particular development would be lessened. This strategy might limit the nation-wide publicity given to participating companies, thereby limiting the contribution of private enterprise.

Besides a new community, the use of the site for [illegible] recreation or conservation appears to be attractive, especially since neither recreation nor conservation are seriously affected by the constraints imposed by air noise and would require smaller investments in public access, utilities, and services. New Industrial sites in this area might also be considered which would add to Boston's tax base and provide employment for city residents.

TRANSPORTATION

in

Introduction

Most developments in the Dorchester Bay site will place some demands upon the local transportation network. Some of these demands will be met by existing services; others may require additional roads or rapid transit lines.

A World's Fair, however, places additional demands upon the regional transportation networks. Past experience indicates that a large number of fair attendees come from without the host city's metropolitan region, placing an additional load upon air, rail and highway services leading into the city. So far, our studies have been directed toward this second area, regional transportation.

A necessary first step in this study was a prediction of the potential attendance for a fair in Boston in 1976. Such a prediction appears in Appendix A. These figures are not intended to determine the exact number of persons who will use the fair. They do, however, give us some insight to the potential problems. Next we formulated a model to predict the origin of fairgoers (distance of travel) and their mode of travel to Boston. This model is presented in Appendix B.

A much more sophisticated analysis will be carried out during the next few months. The details of this analysis are described in the section entitled "Future Transportation Studies".

Vehicular Access Into Boston Present Network

The high travel demands projected for the '76 Fair, and especially the high percentage of those expected to drive into Boston, will impose a serious load on Boston's already clogged arterial system. The system, as it exists today, is shown in Figure 1.

The Massachusetts Turnpike is presently the only Interstate route which leads into Boston without interruption. I-95 and I-93 are not yet complete, and no date of completion is yet in sight for either route.

The most critical area in the present network is in the vicinity of the Fair itself. Only two north-south routes, the Southeast Expressway and Morrissey Boulevard, connect the Fair site with the Massachusetts Turnpike and the proposed Inner Belt. The Southeast Expressway presently carries about 60,000 vehicles per day in each direction, while Morrissey Boulevard handles approximately 24,000 in each direction daily. Both are heavily congested during the morning and evening rush hours and would be useless in serving the Fair at these times.

Proposed 1975 Network

Figure 2 shows the 1975 network as now envisioned by the Massachusetts Department of Public Works. Proposed improvements include completion of I-95, both north and south of Boston; construction of the Inner Belt in Boston and Cambridge; and completion of I-93 and Route 2 to the Inner Belt. Also under discussion at the present time are a third harbor tunnel, and an I-95 bypass to relieve the Central Artery.

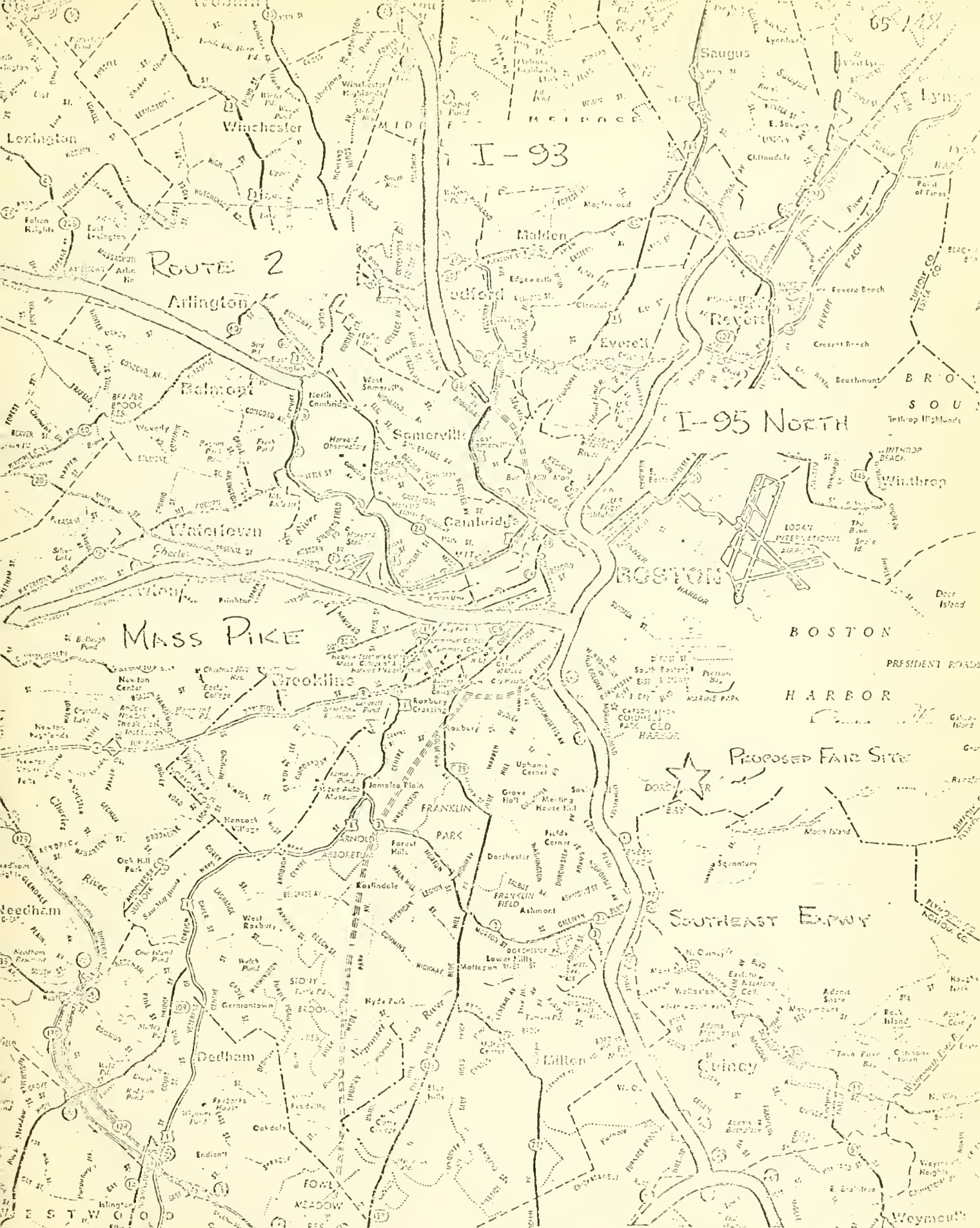


FIGURE 2.1

EXISTING HIGHWAY NETWORK

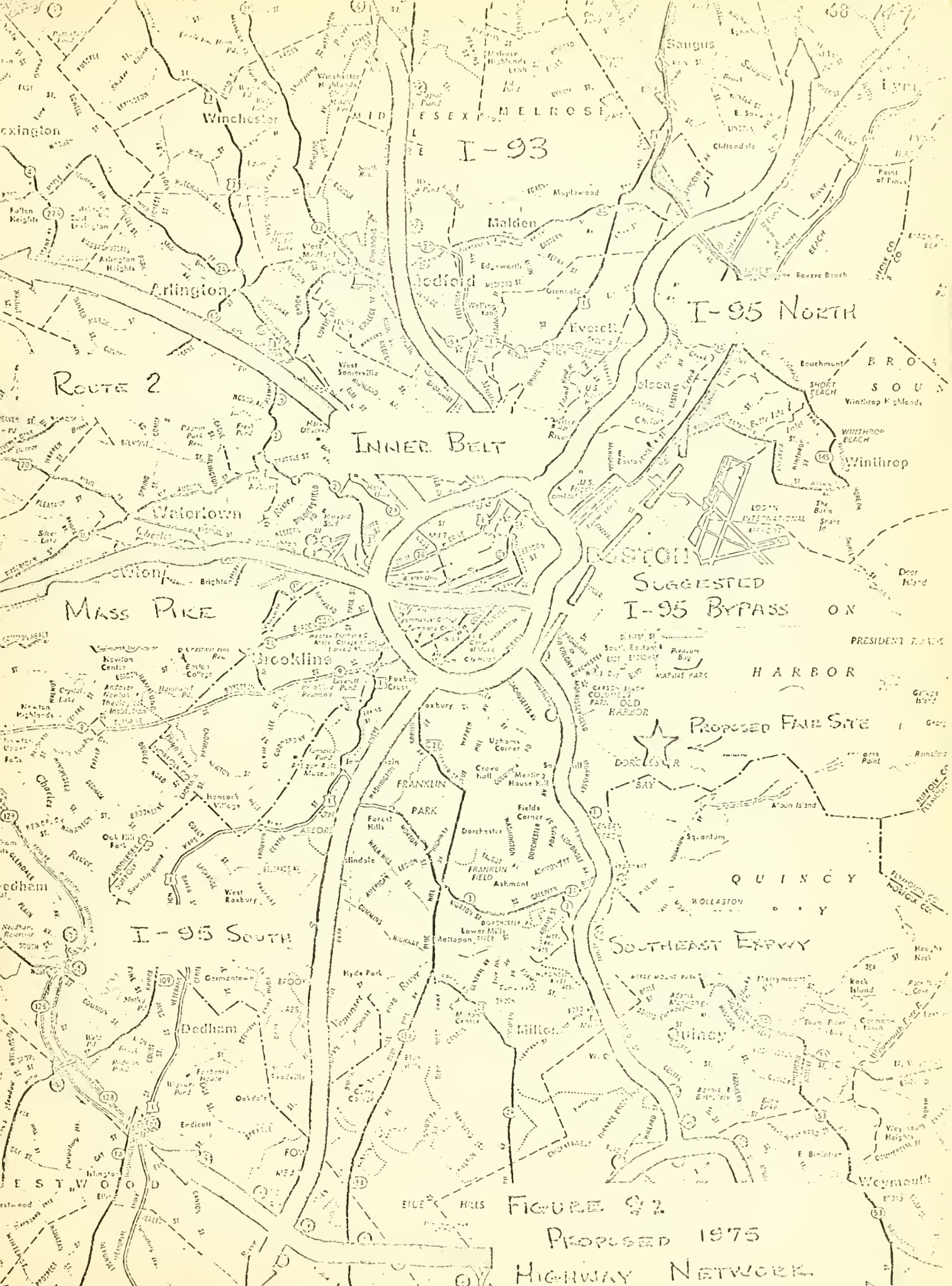


FIGURE 9.2
PROPOSED 1975
HIGHWAY NETWORK

Although plans for some of these highways are in the final design stage, there is danger that controversy may prevent parts of the system from being completed in time to serve the Fair. Jamaica Plain residents have objected to the elevated portion of I-95 through their neighborhood, and Cambridge's opposition to the Inner Belt has thrown the project back to the "study" stage.

These delays have serious implications if the Fair is approved for Boston and if the travel demand approaches the level predicted by the model.

Impact of the Fair: Access

The pattern of daily arrival observed at the Seattle Fair is reproduced in Table 1. There is no reason to believe that a similar pattern will not be true at Boston's Fair. Moreover, it is not unreasonable to apply this same pattern to the arrival of automobiles at the Fair or hotel parking lots. The conclusion drawn from Table I, then, is that the automobiles arriving within the five-hour period from 9:00 A.M. to 2:00 P.M. constitute 75% of the daily total.

TABLE I

TIME OF ARRIVAL

Seattle

	Time	% of total daily attendance that has arrived by this time: (cumulative)
Weekdays	9:00 A.M.	Gates open
	10:00	25%
	11:00	40%
	2:00 P.M.	75%
Weekends	9:00 A.M.	Gates open
	10:00	15%
	11:00	33%
	2:00 P.M.	Sat. 65% Sun. 75%

Average length of stay 6-8 hours.

For the sake of argument, assume the average stay at the Fair is 2-3 days. From Table 4a (Appendix B), the daily flux of automobiles ranges from 13,900 to 80,200 into and out of the city. Seventy-five per cent of these will come between 9:00 A.M. and 2:00 P.M.; or approximately 10,500 to 60,000 vehicles. The hourly rate during this period is then 2,100 - 12,000 vehicles/hour.

It is assumed that the 1975 highway network is complete, then, allowing for the dense population centers to the south and west of Boston, a rough split of the total incoming vehicular traffic can be made among the four Interstate routes: I-90 and I-95 South will each carry about 40% of the total incoming traffic, while I-93 and I-95 North will each carry about 5%. Using the vehicle flow rates derived above, the major arteries (I-90 and I-95 South) will each carry a projected 840 - 4,800 vehicles per hour.

Highway capacity is estimated at 1,500 vehicles per hour per lane. Roughly speaking, then, the Fair, under the assumptions made, will add the equivalent of one to three lanes of traffic to Boston's traffic arteries. (It must be remembered that this flow rate was obtained using Table 4a, Appendix B, the weekday model; therefore, 880-4800 vehicles per hour must be superimposed on the projected work traffic load in 1975. On weekends there will be little work traffic, but the weekend model in Table 4b, Appendix B, yields higher traffic loads generated by the Fair.)

Transportation from Boston to the Fair
Present Systems

At the present time three modes of transportation are available in Boston: (1) private means, such as walking or driving an automobile; (2) public transportation, such as the MBTA network or taxicabs; and (3) chartered service provided by many bus companies within the area. Because most Fair visitors are usually part of a family group rather than a business or club group, it is expected the (1) and (3) will dominate.
X (2)

As mentioned earlier, there is a good chance that many Bostonians, familiar with the hardships of driving and parking in their city, will choose rapid transit when going to the Fair. The same can probably be said of those staying in town in hotels. The actual percentages in the modal split are, however, still unknown.

The present rapid transit system (Figure 3) consists of four lines, with two extensions under construction. In the Master Plan for 1975 (Figure 4) the MBTA has proposed expansion of the Orange, Red, and Green Lines; along with other service improvements. However the Master Plan, like the highway program, is subject to delays, and just how much of the system will be in operation by 1975 is problematical.

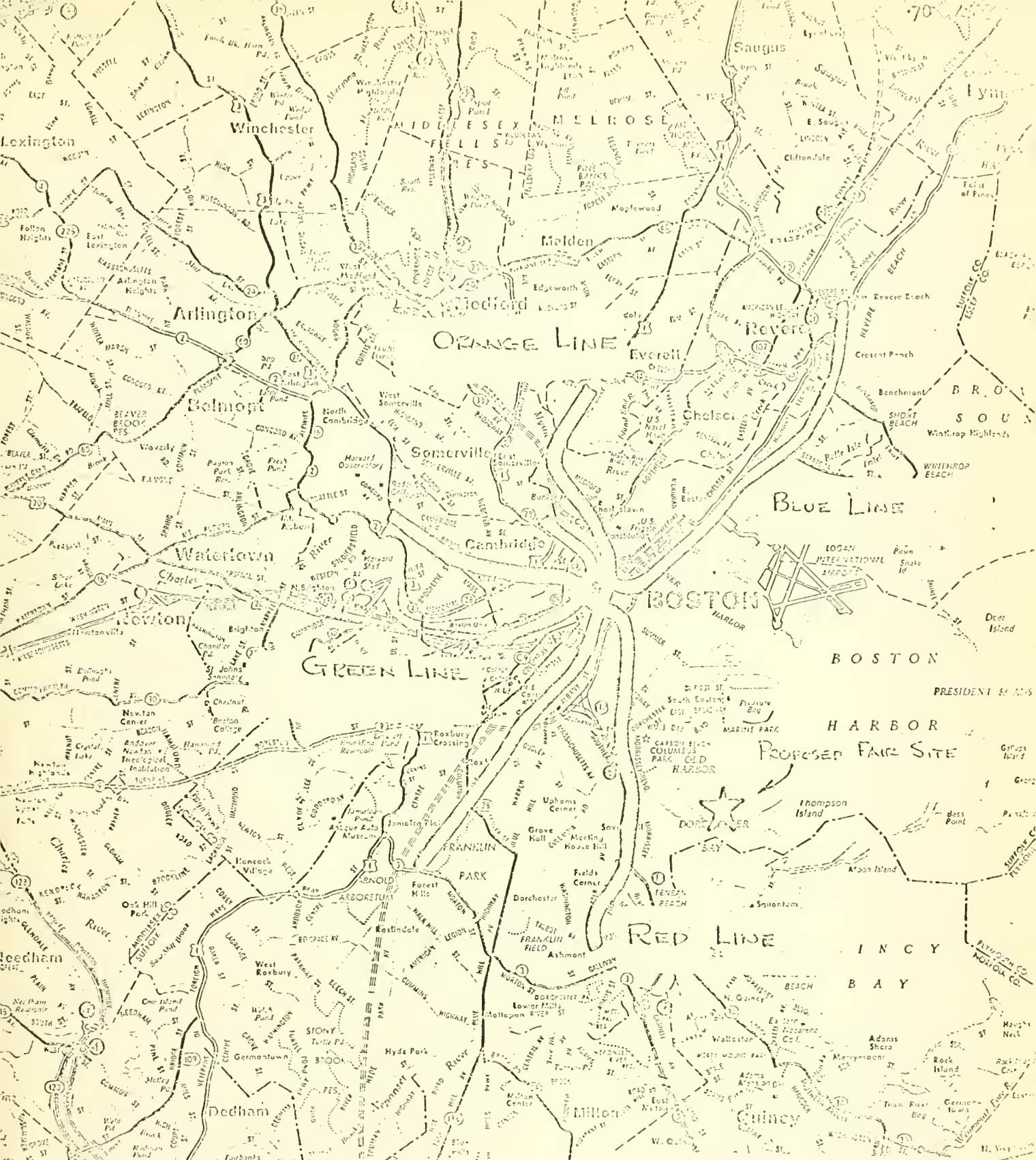


FIGURE 10.3

EXISTING MBTA RAPID TRANSIT SYSTEM

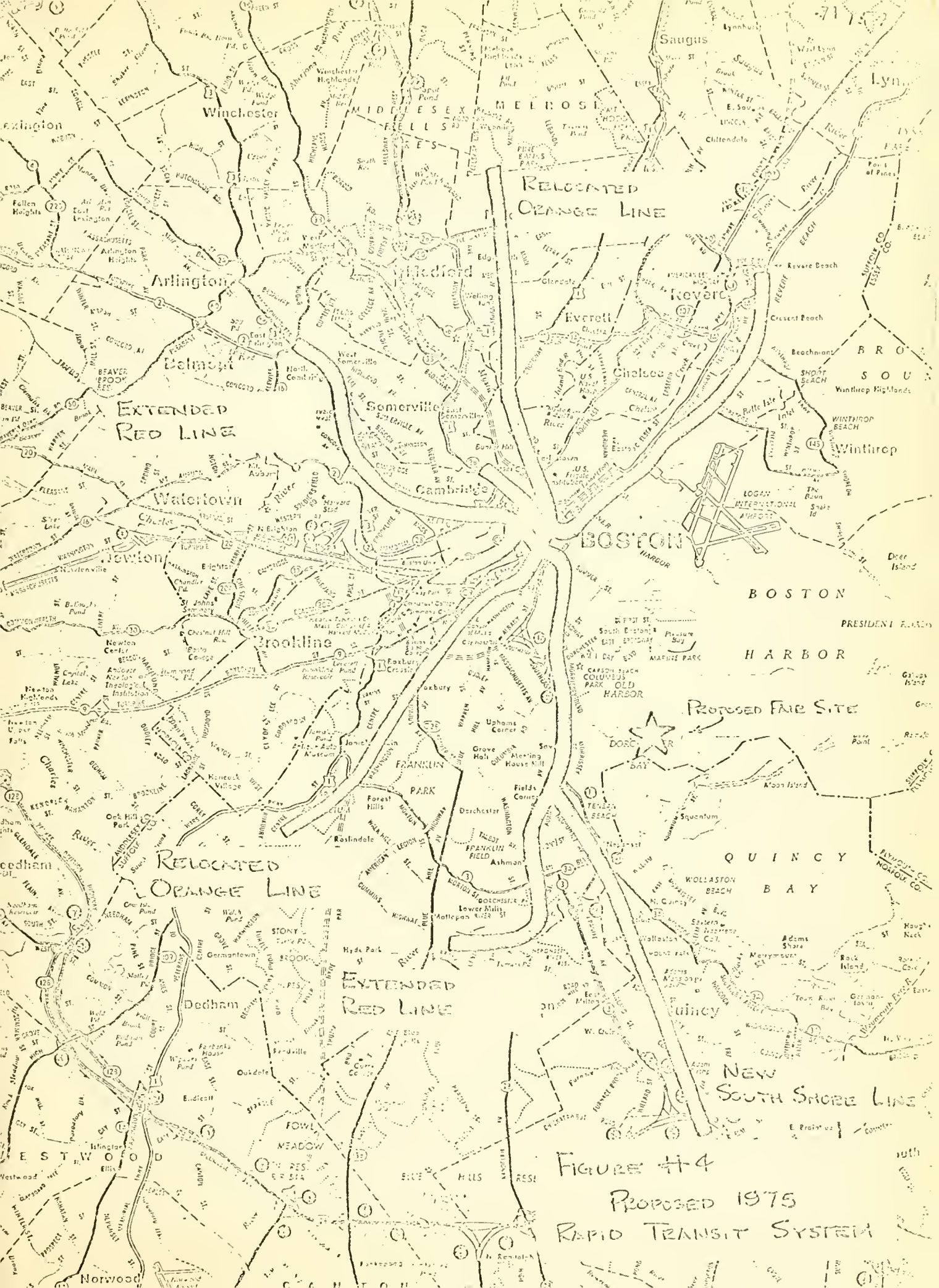


FIGURE 4-4

PROPOSED 1975 RAPID TRANSIT SYSTEM

Impact of the Fair

Consider first the local residents who go to the Fair. It is argued in Appendix B that Zone I visitors are predominantly weekend visitors. Using Table 4b (Appendix B) an estimate of 32,000 to 105,000 persons per day is proposed for Zone I on weekends. Seventy-five per cent of these arrive during the 9:00 A.M. - 2:00 P.M. period, or approximately 15% for each of the 5 hours. This yields a flow rate of 4,800 to 15,800 persons per hour. Zone I includes Boston and its surrounding communities. Most of the visitors from Boston proper and the nearby communities will probably take rapid transit; those from the outlying communities will probably drive, at least over part of the trip. If an even split between MBTA and automobiles is made (suggested by the population distribution within Zone I), this implies a flow rate of about 2,400 - 7,900 persons per hour using rapid transit lines. This certainly would provide no problems -- the Harvard-Ashmont line carries 16,000 people during the weekday rush hour. Thus, one may conclude that even if some residents in outlying suburbs chose to drive part of the way and then complete the trip on the MBTA, the present system could handle it.

Now consider the visitors staying in downtown hotels or other overnight Fair accommodations. If the average stay of these visitors is 2-3 days, the estimates given by the weekday model are 37,000 to 235,000 persons lodged in town. Table 1 shows that on weekdays perhaps 25% of the total day's attendance arrives during the first hour. It is thought that this rush is due to the out-of-town visitors who

have stayed overnight, who can get to the Fair early, and who do so in order to do as much sightseeing as possible. One-quarter of the estimated total hotel visitors is about 9,000 to 58,700 people; this is equivalent to saying that a flow rate of 9,300 to 58,700 persons per hour will be superimposed on the usual morning rush hour traffic.

Transportation Within The Fair

Movement of people within the Fair will be determined largely by the "attractability" and locations of exhibits and by the physical layout of the transportation system itself. At Seattle it was found that people tend to gravitate toward the center of the Fair, even if there is a fairly attractive exhibit near the periphery. This fact should be kept in mind if the present Fair plan is adopted. (Specifically, a close look should be taken at the core area to judge its capacity to handle large crowds.)

To quantify the discussion, it was found that an average length of stay of the Seattle Fair was about 6-8 hours. If this holds true for Boston, a peak accumulation of about 310,000 to 420,000 would occur on weekends at about 3:00 P.M. It was also found at Seattle that the flow rate past a point near the center of the Fair was about 200 persons/minute. Assuming that the Boston Fair will attract on the order of ten times more visitors than Seattle, the flow rate through the core of Expo '76 might be 1,000 persons per minute or more. This is an extremely heavy flow rate, and even a system on the order of an MBTA subway probably could not carry it. (From before: one MBTA line presently carries about 16,000 persons during the rush hour, or about 270 persons per minute.)

Some possible remedies to this problem would be to put prime attractions at the outer theme centers rather than in the core, and to include within the transportation system a bypass of the core area.

Future Transportation Studies

The model presented estimates the number of people who will come to Boston, then analyzes the impact upon Boston's transportation network. A more reasonable approach might be to determine how many additional visitors can be accommodated by Boston's transportation network, and then analyze the impact of this attendance level on the fair. It is then possible to approach the problem from the standpoint of optimization. If the number of people who can be accommodated by the City of Boston (here one must consider not only transportation, but also hotels, restaurants, etc.) is greater than the desired attendance for the fair, then the fair plan may be corrected to accommodate and attract additional visitors. (Or, an equally valid approach might be to leave the fair as planned, and not risk taxing the available services.) If, on the other hand, the City of Boston cannot accommodate the number of people projected for a desirable fair attendance, then the available accommodations may be expanded to meet the projected demand. Again, however, it may prove desirable not to alter existing services, but rather to tailor the fair to a smaller attendance, and to restrict advertising and promotion in an effort to control the expected number of attendees. This might make the fair a more pleasant experience for both the attendee and for the City of Boston.

APPENDIX A

PREDICTION OF 1976 FAIR ATTENDANCE

Attendance predictions for recent World's Fairs have been generally inaccurate. Montreal's Expo '67, for example, drew 70% more people than expected, while New York's 1964 Fair fell 33% below projected total attendance. Although a correct forecast of 9.6 million visitors was made for Seattle's 1962 Fair, this forecase in fact contained several offsetting errors. Data on World's Fair attendance are simply too difficult to collect and correlate. When compared with other reasons for travel -- business meetings or vacations, for example -- World's Fairs are relatively infrequent events. They are also variable in their appeal, depending upon their size, which nations sponsor or attend the Fair, and what exhibits or attractions are displayed.

When prediction models are not available, one recourse is to study past and present trends in Fair attendance and to project them to some future date. Statistics are available for three recent Fairs held in North America; these are summarized in Table 1.

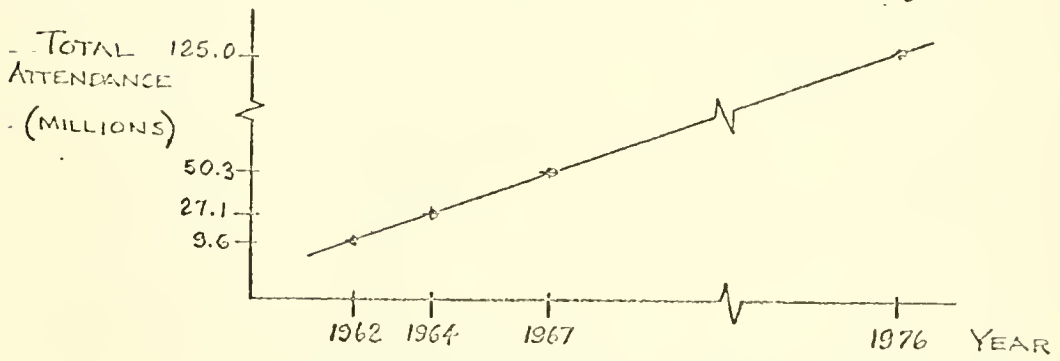
Table 1. Attendance at Recent Fairs

Fair	Total 6-month attendance	Average 1-day attendance	Pead-day attendance
Seattle, 1962	9,600,000	51,000	111,080
New York, 1964	27,148,000	155,000	---
Montreal, 1967	50,307,000	272,000	569,500

(The average attendance figure is obtained by dividing the total attendance by 185 days. The peak attendance figure has been read from the turnstiles. Note that the peak attendance was approximately twice the average attendance at both Seattle and Montreal.)

If the total attendance figures are plotted against the respective year for each fair, and a linear extrapolation is made, the projected total attendance for Boston Expo '76 is 125 million persons. See Figure 1.

Figure 1. Linear Extrapolation of Recent Attendance Figures



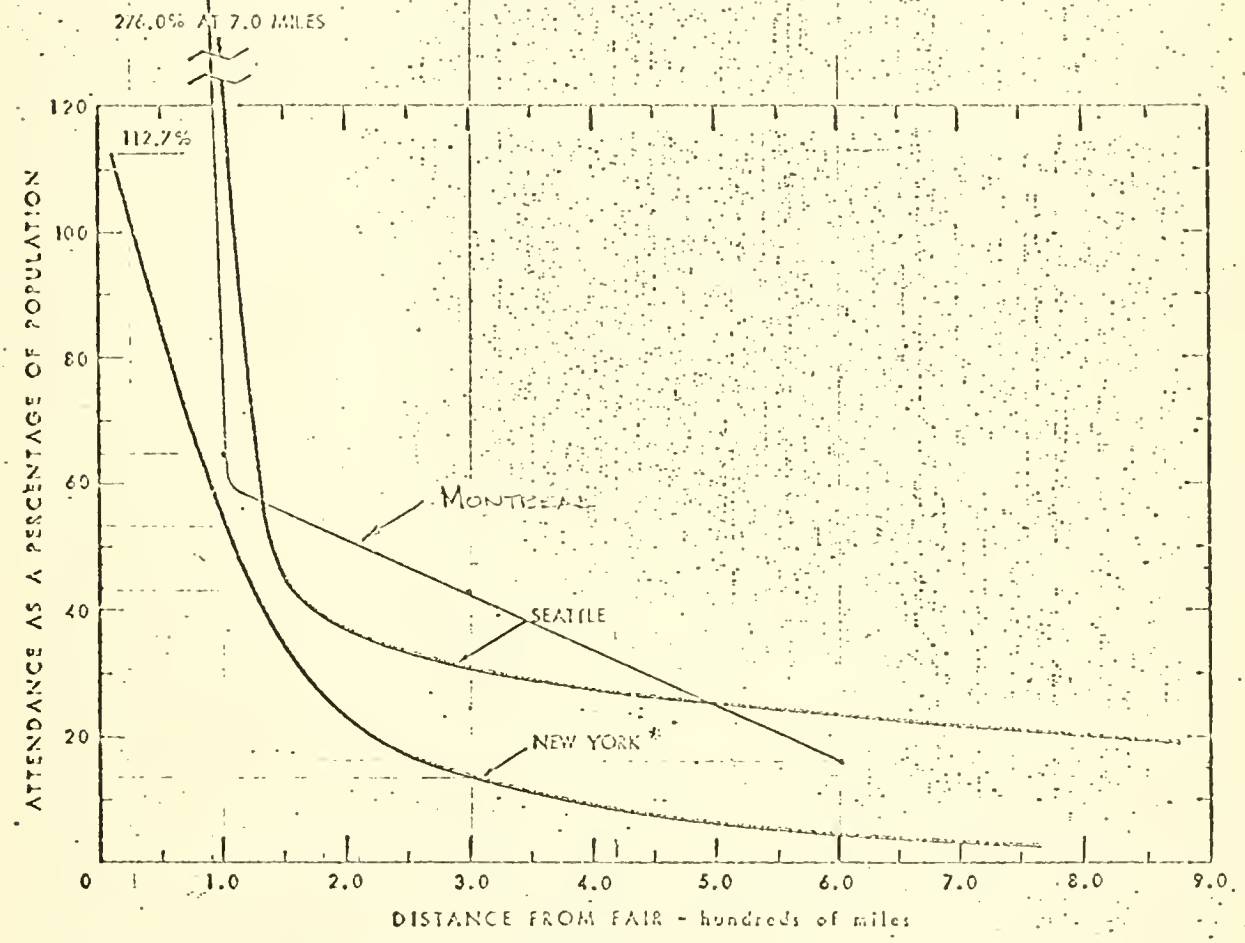
Clearly the simple linear approximation is not adequate to project an accurate total attendance figure for a fair seven years from now. Such a model does not account for the effects of mass media, possible bad press reviews, or the ability of the City of Boston to handle that many people. On the other hand, present trends in American Life such as increased affluence, leisure time, and ease of mobility suggest some potential attendance figure for 1976 at least as great as Montreal's 50-million in 1967.

Market Penetration

One method of predicting fair attendance is called market penetration analysis. Market penetration is defined as the attendance from a particular region divided by the population of that region. Thus, if the number of people from a certain State who attend an event is N and the total population of that State is P, the market penetration for that State is defined as $\frac{N}{P}$, usually expressed in percent.

Market penetration is frequently plotted as a function of distance from a fair or event. Market penetration curves for the Seattle, New York, and Montreal fairs are presented in figure 2. To use market penetration to predict attendance at Boston Expo 1976, one applies the market penetration curve for a world's fair in Boston to the projected 1976 population distribution. The problem with this approach is readily apparent - Boston has never had a World's Fair, and its market penetration is unknown.

Among other things, market penetration is a function of a fair's appeal, the cultural and economic make-up of the surrounding population, and the transportation facilities available. Rather than attempt to plot a priori a market penetration curve for Boston, we chose to use the New York curve as a lower bound and Montreal's curve as an upper bound. This does not mean that Boston's potential market lies geographically between those of New York and Montreal. What it does represent is the selection of two curves, one for a very successful fair and one for a mediocre fair, to serve as assumed boundaries for Boston's drawing power.



* Adjusted to represent New York's market penetration as a one-year fair.

SOURCES: CENTURY 21, INC.; NEW YORK WORLD'S FAIR CORPORATION; STANFORD RESEARCH INSTITUTE.

FIG. 2 MARKET PENETRATION BY THE SEATTLE AND NEW YORK WORLD'S FAIRS AND MONTREAL

Applying the New York and the Montreal market penetration curves to projected 1975 populations, we estimate that the total attendance at Boston Expo '76 will range from 29 million to 72 million. (Using their own New York curve, SRI estimated Philadelphia's Bicentennial attendance at 33.4 million.)

The average daily attendance, which is the total attendance divided by 185 days - the length of the Fair's run is 157,000 - 390,000. Peak day attendance, which experience shows to be about twice the average daily figure, is expected to be 314,000 - 780,000 . This information is summarized in Table 2.

Table 2. Fair Attendance Estimates

	Lower Bound	Upper Bound
Total Attendance	29 million	72 million
Average Daily Attendance	157,000	390,000
Peak day attendance	314,000	780,000

Average and peak-day gates relate directly to a Fair's overall attendance: they are unsuitable for use in designing transportation systems which must meet day by day fluctuations in demand. Figures 3a and 3b, showing weekly attendance patterns at Seattle and Montreal respectively, illustrate this point. The daily attendance during the work-week is generally 35% below the average, while on the weekend it may jump to about 35% above the average. The vacation months are exceptions to this rule - weekday attendances in July and August at Seattle and Montreal, for example, were about 20% above the average, rather than 35% below it. Also, weekend attendance at Montreal and Seattle

Weekly Attendance Patterns at Seattle and Montreal

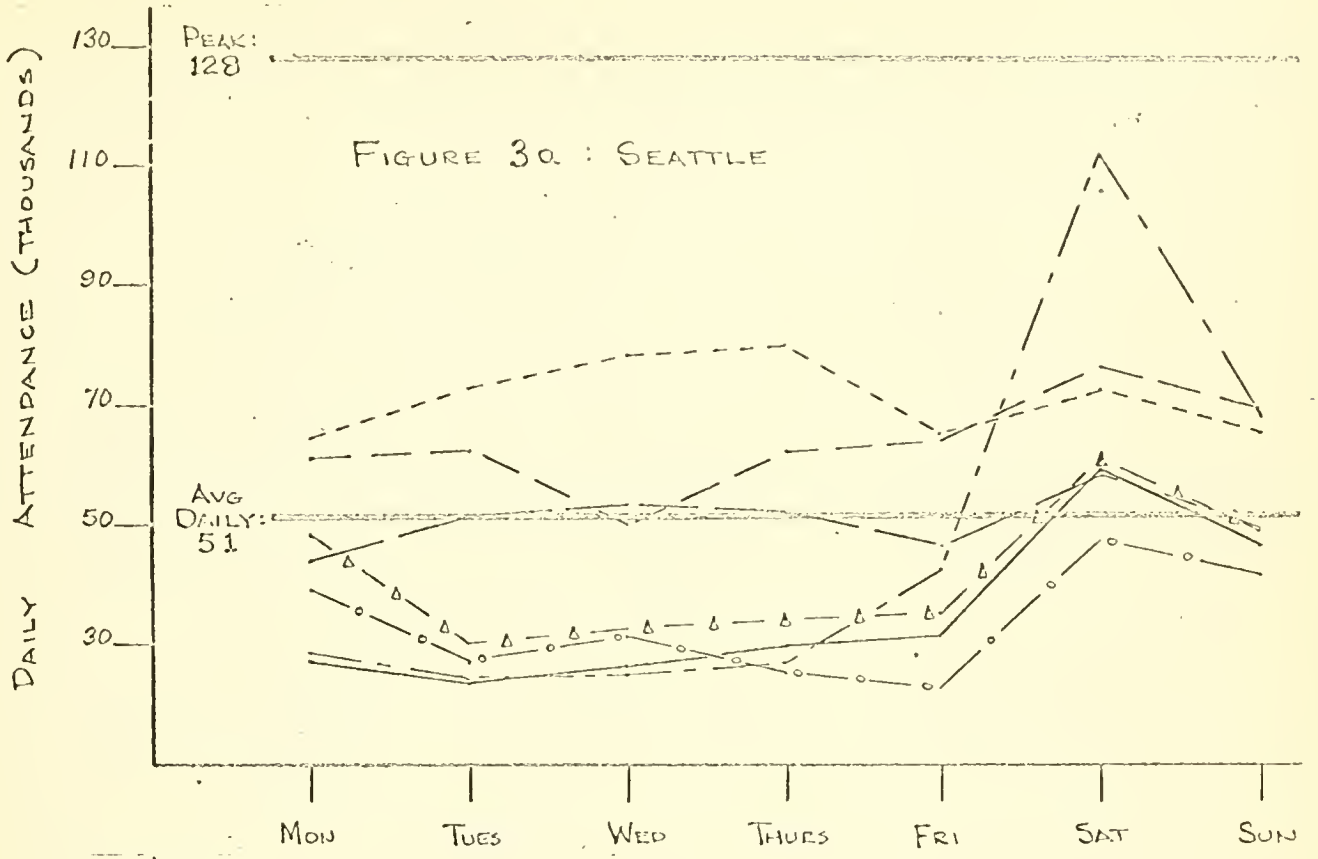


Figure 3a : Seattle

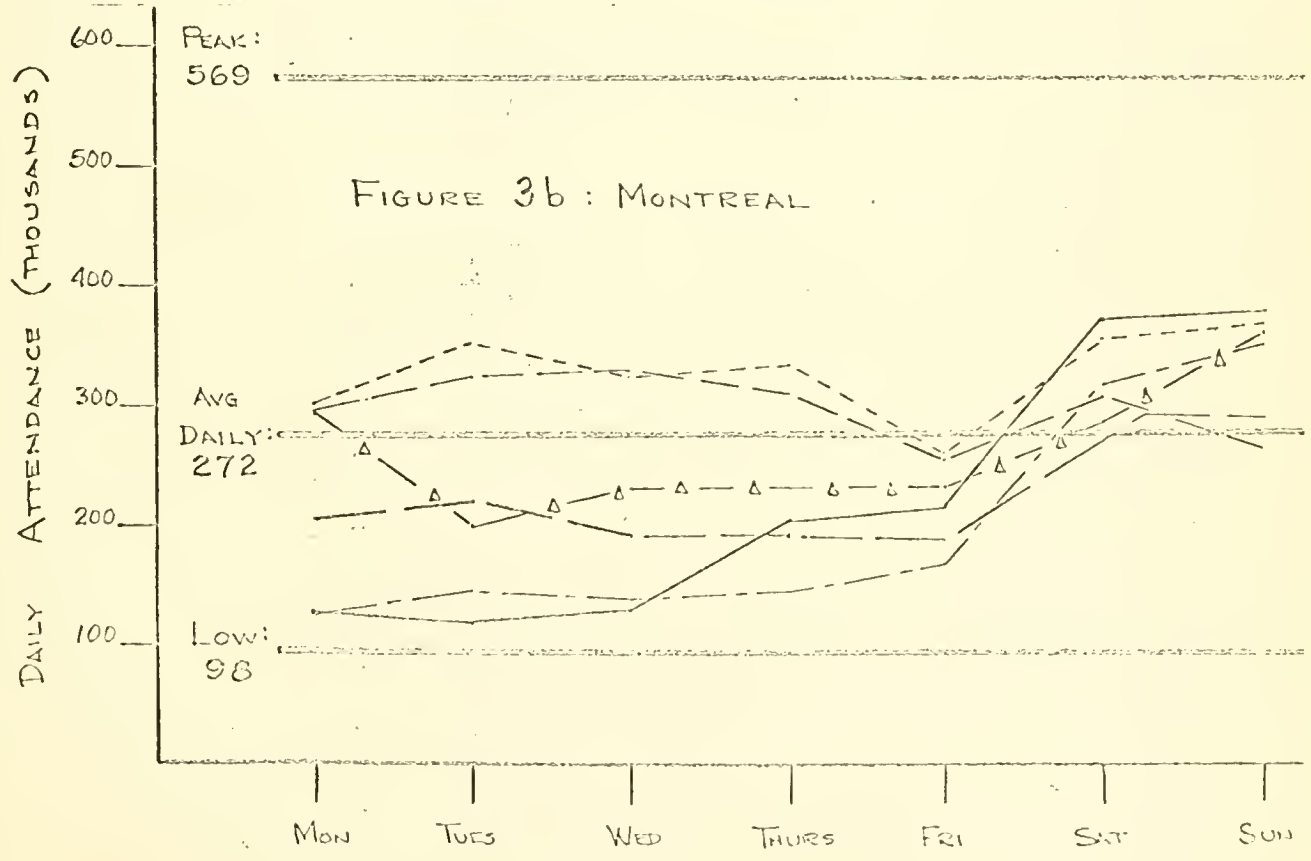


Figure 3b : Montreal

First Full Week in April
" " " May
" " " June
" " " July
First Full Week in August
" " " September
" " " October

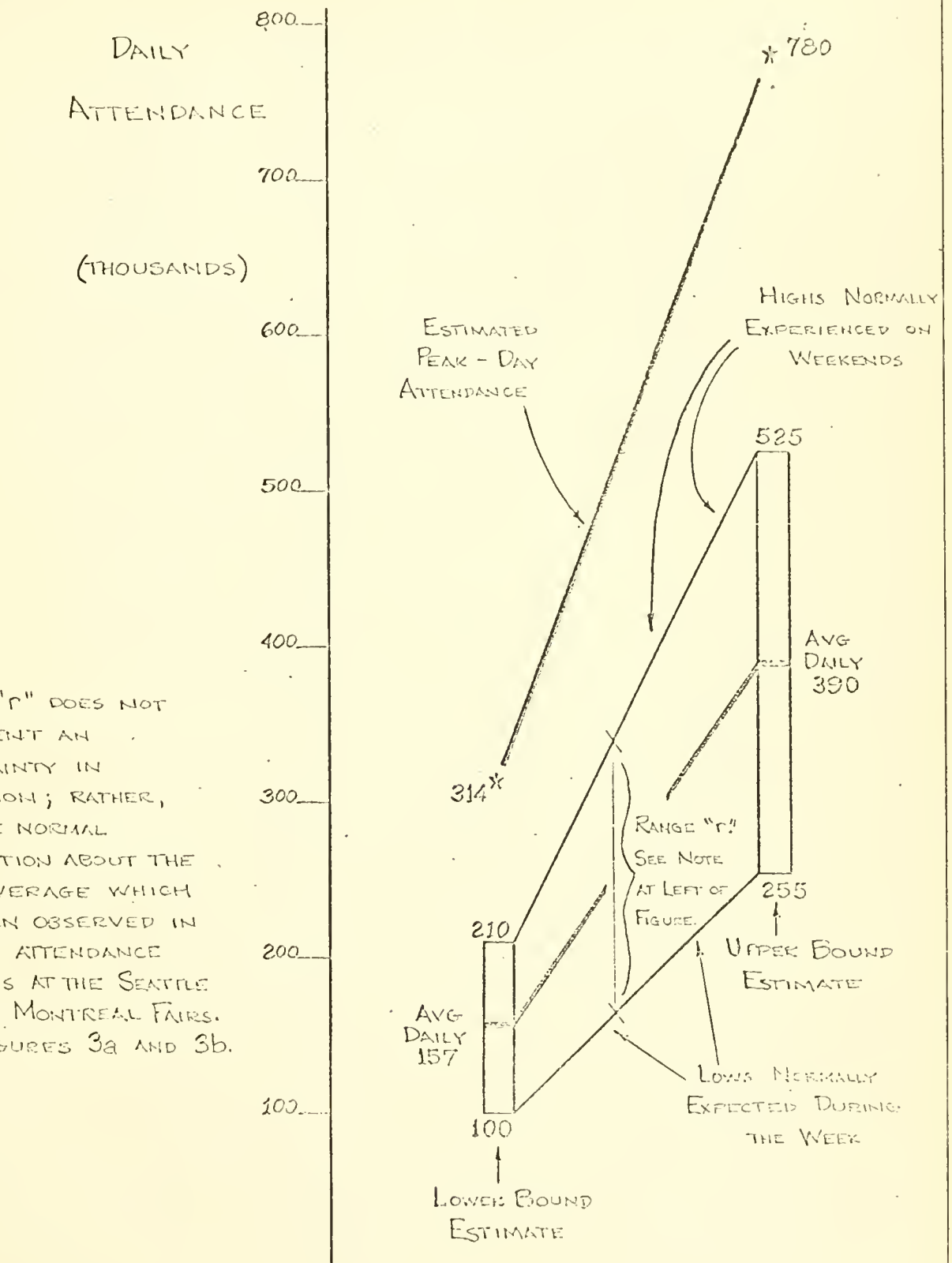
were occasionally close to the average, rather than 35% above. Taking these observations into account, we project the following "design ranges". (Table 3)

Table 3. Design Range for Daily Attendance

	Lower Bound	Upper Bound
35% below Average Daily Attendance	100,000	255,000
35% above Average Daily Attendance	210,000	525,000
Estimated Daily Attendance Ranges		
Weekday Attendance	100,000-190,000	255,000-470,000
Weekend Attendance	160,000-210,000	390,000-525,000

The design range and the resulting expected attendances for weekday and weekend are presented in graphical form in figures 4 and 5.

FIGURE 4: DESIGN RANGE FOR DAILY ATTENDANCE



NOTE :

RANGE "r" DOES NOT REPRESENT AN UNCERTAINTY IN PREDICTION; RATHER, IT IS THE NORMAL FLUCTUATION ABOUT THE DAILY AVERAGE WHICH HAS BEEN OBSERVED IN WEEKLY ATTENDANCE PATTERNS AT THE SEATTLE AND THE MONTREAL FAIRS. SEE FIGURES 3a AND 3b.

FIGURE 5a. ESTIMATED DAILY ATTENDANCE RANGE FOR WEEKDAYS

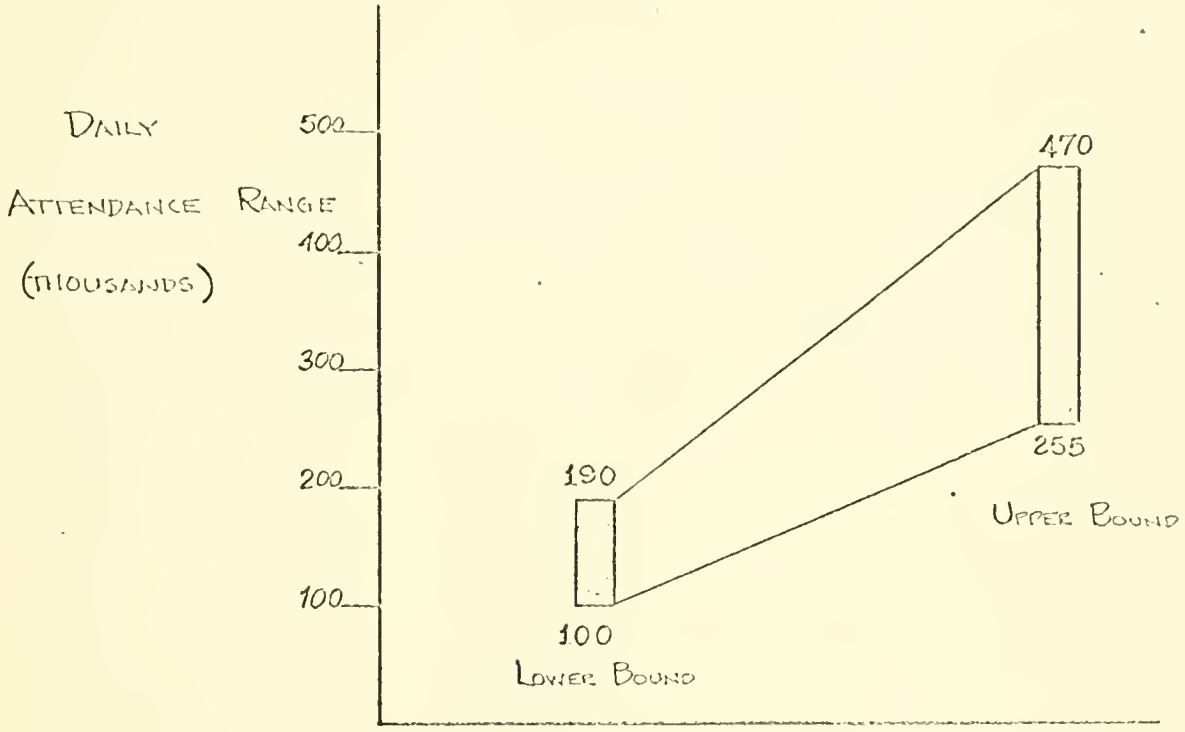
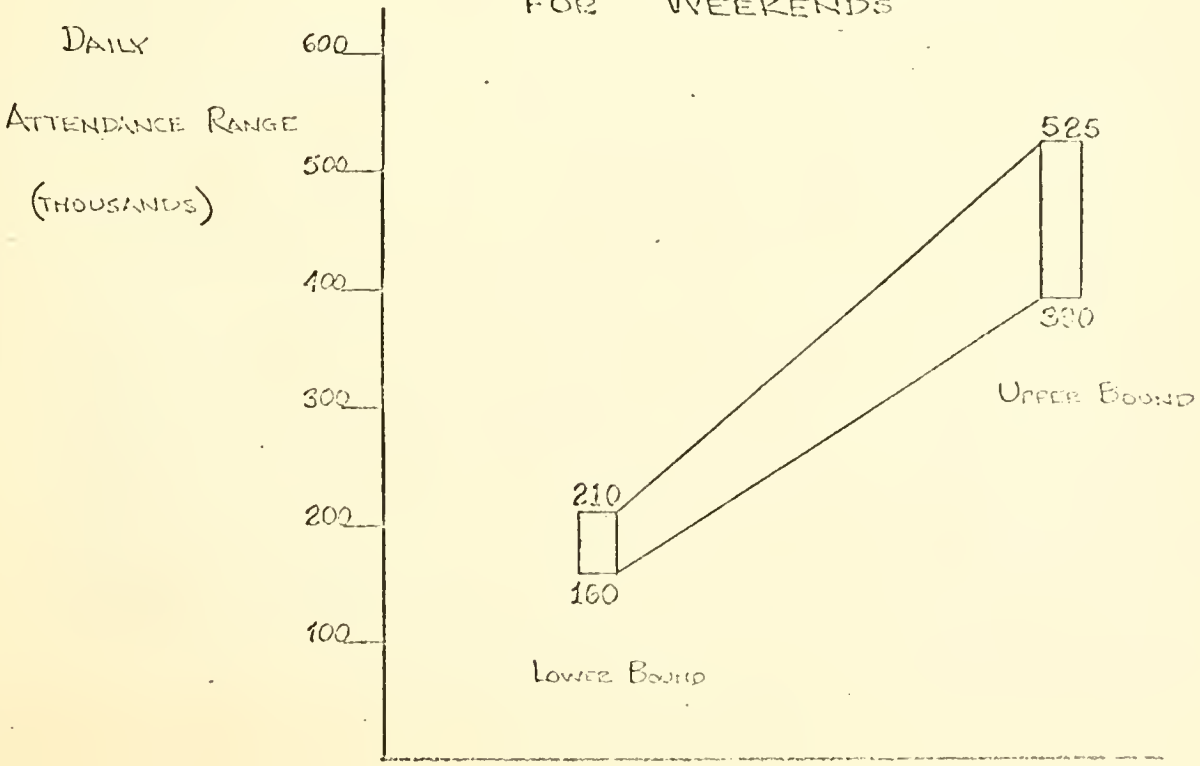


FIGURE 5b. ESTIMATED DAILY ATTENDANCE RANGE FOR WEEKENDS



APPENDIX B

FORMULATION OF A TRAVEL DEMAND MODEL

In Appendix A we determined a range of average day and peak day attendance figures for a 1976 exposition in Boston. The next step is to formulate a model that describes the origin of the fair visitors and their mode of travel. Table 1a gives a division of distances travelled by visitors to the Seattle Fair. Table 1b gives a breakdown of distance travelled by visitors to the Montreal Fair.

Table 1a
Visitors' Geographical Origin - Seattle

Day, date	Percent of total daily visitors from within 150 mi.	Percent of total daily visitors from beyond 150
3 July - Tues	25%	75%
4 July - omitted from survey	--	--
5 July, Thurs	17	83
6 July, Fri.	30	70
7 July, Sat.	45	55
Totals	29%	71%
22 July, Sat	41	59

Table 1b
Visitors' Geographical Origin - Montreal

Distance of Origin from Montreal	% of total visitors
Montreal proper	18%
Greater Montreal	5
Within 200 mi, excl. Gr. Montreal	7
200-400 mi.	30
400-800	18
800-1600	10
1600-2300	3
Greater than 2300	3
Outside US & Canada	6
	100%

In order to apply the Montreal and Seattle information to the 1976 Boston Fair, concentric zones have been drawn around the Hub site. (Figure 1) These zones are:

Zone I: Boston and the Metropolitan Region (Area within 30 miles of the site)
Zone II: Area included within a 30 to 150 mile radius
Zone III: Area included within a 150-300 mile radius
Zone IV: Area beyond 300 miles from the Fair

A breakdown of origin of Fair visitors is shown in Tables 2a and 2b; the basis of this breakdown follows:

Table 2a Weekdays -- Expected daily attendance range: 100,000 to 470,000

Zone	Percentage of daily attendance originating from this zone	
I	10%	10,000 - 47,000
II	15%	15,000 - 70,500
III	20%	20,000 - 94,000
IV	55%	55,000 -259,000
	100%	100,000 470,000

Table 2b Weekends-Expected daily attendance range: 160,000 to 525,000

I	20%	32,000 -105,000
II	20%	32,000 -105,000
III	20%	32,100 -105,000
IV	40%	64,000 -210,000
	100%	160,000 525,000

Basis for the Fair Attendance Model

(1) There appear to be no important conflicts between the Seattle and the Montreal information, although the Fairs were different in nature and in location. This lends weight to the generalizations which follow, although it by no means insures that they are correct.

(2) The percentages for Zones I and II combined were obtained from Table Ia: approximately 25% of

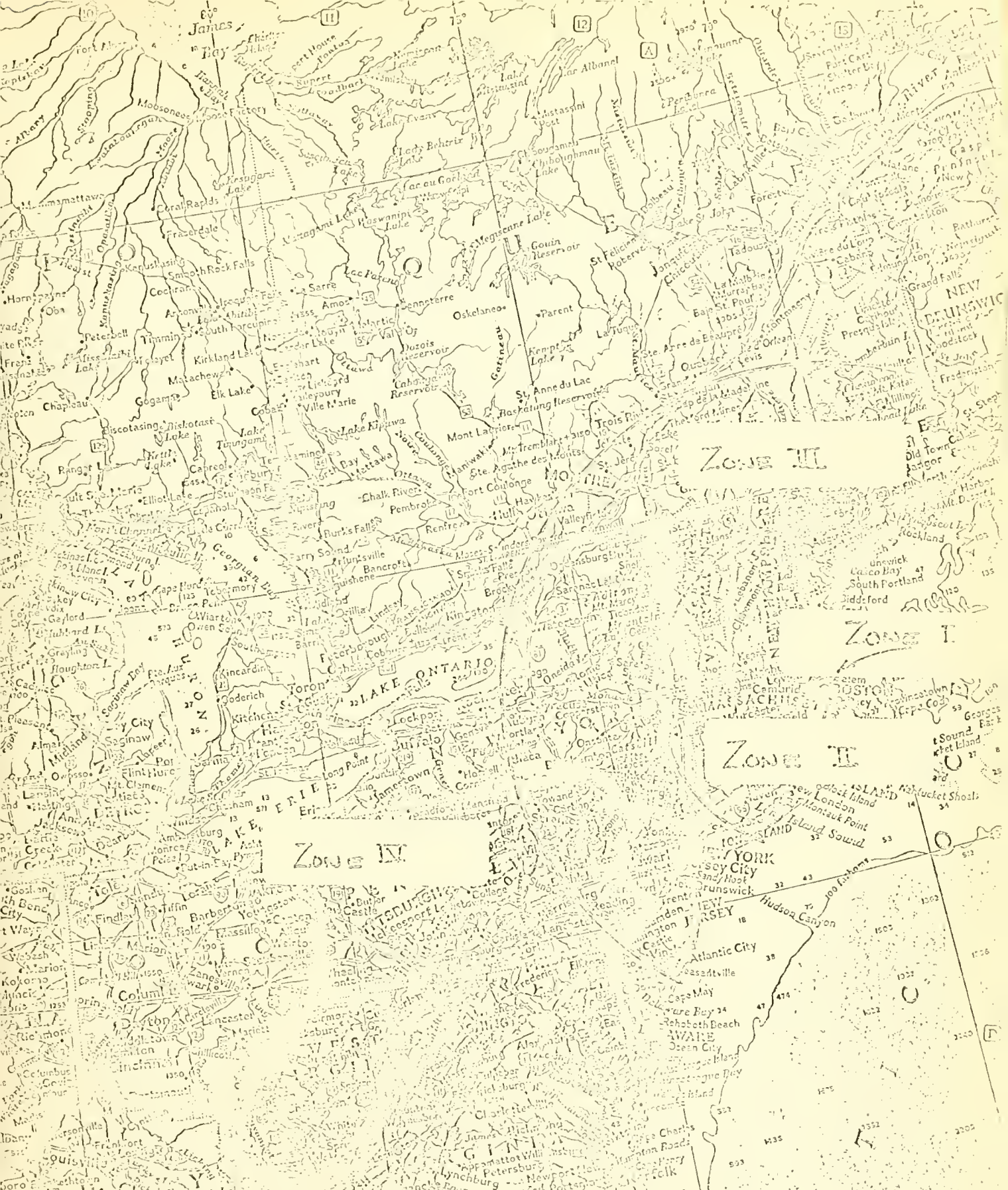


FIGURE #1

BOSTON AND SURROUNDING AREA

weekday Fair customers at Seattle were from within 150 miles, while on the weekends this percentage jumped to 40. The actual split between Zone I and Zone II was somewhat arbitrary. However, consideration is given to the fact that the closer one lives to the Fair, the more likely one is to visit it on a weekend, rather than spend a mid-week vacation there. Hence, Zone I would probably experience a greater jump in attendance on weekends than would Zone II. From these considerations resulted the breakdown given in Tables 2a and 2b.

(3) The percentages for Zone III were based on the assumption that approximately 1/2 of all Fairgoers will come from within a 300 mile radius. This assumption is supported by extrapolation of Seattle's data for a 150 mile radius, and by attendance origins observed in Montreal (Tables 2a and 2b). The actual percentages used for attendance from within 300 miles were 45% and 60% to account for the 15% rise on weekends explained in (2); the percentages for Zone I plus Zone II were then subtracted from 45% - 60% to get the 20% - 20% weekday--weekend figures for Zone III.

A second feature of the model is the prediction of modes of transportation used by the visitors from various zones. Both the Montreal and the Seattle data indicate a heavy reliance on private automobiles, regardless of distance from the Fair. (Table 3).

Considering the extensive interstate highway system serving Boston from the north, south, and west, and

Table 3
Method of Travel

Montreal

	Apr. May, June	July, Aug	Sept., Oct.	Average
Car	49.8%	73.4%	65.4%	62.8%
Train	13.5%	1.7%	5.6%	6.9%
Bus	20.2%	15.2%	9.3%	14.9%
Plane	16.5%	9.1%	18.6%	14.7%
Other	0	0.6%	1.1%	0.7%

Seattle

	500 miles distant	500 miles distant	Average
Car	75%	60%	67.5%
Train	-	4%	2.0%
Bus	18%	12%	15.0%
Plane	3%	16%	9.5%
Other	4%	8%	6.0%

especially the links between Boston and the dense New York Metropolitan Area, it was felt reasonable to assume that 75% of all Fair visitors from within 300 miles of Boston would arrive by car, whereas 60% of all Fairgoers from beyond 300 miles of Boston would drive.

A word of caution should be mentioned here. The model does not imply that 75% of all visitors from Zone 1 (Boston and vicinity) will drive. As a matter of fact, it is quite probable that many Bostonians will choose public transportation and avoid the headaches of driving and parking at the Fair. However, the fraction of visitors from, say 50 miles and beyond who drive will probably be high enough to make up for this. The 75% figure applies, then, to Zones I, II, and III combined, but not necessarily to any zone in particular.

An additional consideration which should be included in this model is the average length of stay of the visitors, because it affects the magnitude of the daily flux of Fairgoers into and out of Boston. For example, suppose it is known that 300,000 out-of-town visitors pass through the Fair's turnstiles daily. If all these persons have planned just one day at the Fair, then every day 300,000 visitors enter and leave Boston. If, on the other hand, they all stay for two days, then, on the average, only 150,000 enter and leave Boston daily; the other 150,000 are spending their night in a hotel. For any given daily attendance the daily flux decreases as the average length of stay increase. However, more hotel units will be required to house those visitors who stay overnight.

For computational simplicity, the following two assumptions have been made: (1) All Fair visitors from a distance greater than 150 miles (Zones III and IV) will stay for more than one day at the Fair; and (2) the length of stay of all these visitors will be the same. While a model based on these assumptions, especially (2), does not simulate a real situation, it will show approximately the effects on transportation if, for example, most out-of-towners stay for three days as opposed to two days.

Tables 4a and 4b show the complete transportation model. The model includes all the preceding information and assumptions. An average automobile occupancy of 2.5 persons/vehicle and a hotel occupancy of 2.5 persons/unit were used. A graphical representation of some results of the model is given in Figures 2a and 2b

Zone I --Boston and vicinity
Zone II -- 30 to 150 miles from Boston
Zone III -- 150 to 300 miles from Boston
Zone IV -- Beyond 300 miles from Boston

TABLE 4a

WEEKDAY TRANSPORTATION MODEL

DAILY ARRIVALS * INTO BOSTON

ASSUMED LENGTH OF STAY (APPLIES TO ZONES III & IV) ↓	ZONE I (persons)	ZONE II (persons)	ZONE III (persons)	ZONE IV (persons)	NO. OF VEHICLES (autos)	NO. HOTEL UNITS REQD
1 day	10,000 - 47,000	15,000 - 70,500	20,000 - 94,000	55,000 - 259,000	26,700 - 125,500	Zero
2 days	10,000 - 47,000	15,000 - 70,500	10,000 - 47,000	27,500 - 129,500	17,100 - 80,200	15,000 - 71,000
3 days	10,000 - 47,000	15,000 - 70,500	6,700 - 31,300	18,300 - 86,300	13,900 - 65,100	20,000 - 94,000
4 days	10,000 - 47,000	15,000 - 70,500	5,000 - 23,500	13,750 - 64,750	12,000 - 57,500	22,500 - 106,000

* "DAILY ARRIVALS" REFERS TO ALL FAIRGOERS OUT-OF-STATE VISITORS EXCEPT THOSE WHO HAVE SPENT THE PREVIOUS NIGHT IN HOTELS OR SIMILAR LODGINGS DOWNTOWN. IT IS MEANT TO SHOW THE DAILY FLUX OF FAIRGOERS INTO & OUT OF THE CITY (ZONES II, III, AND IV), OR THE DAILY MOVEMENT OF LOCAL FAIRGOERS WITHIN THE CITY (ZONE I).

Table 4b

WEEKEND TRANSPORTATION MODEL

DAILY ARRIVALS* INTO BOSTON

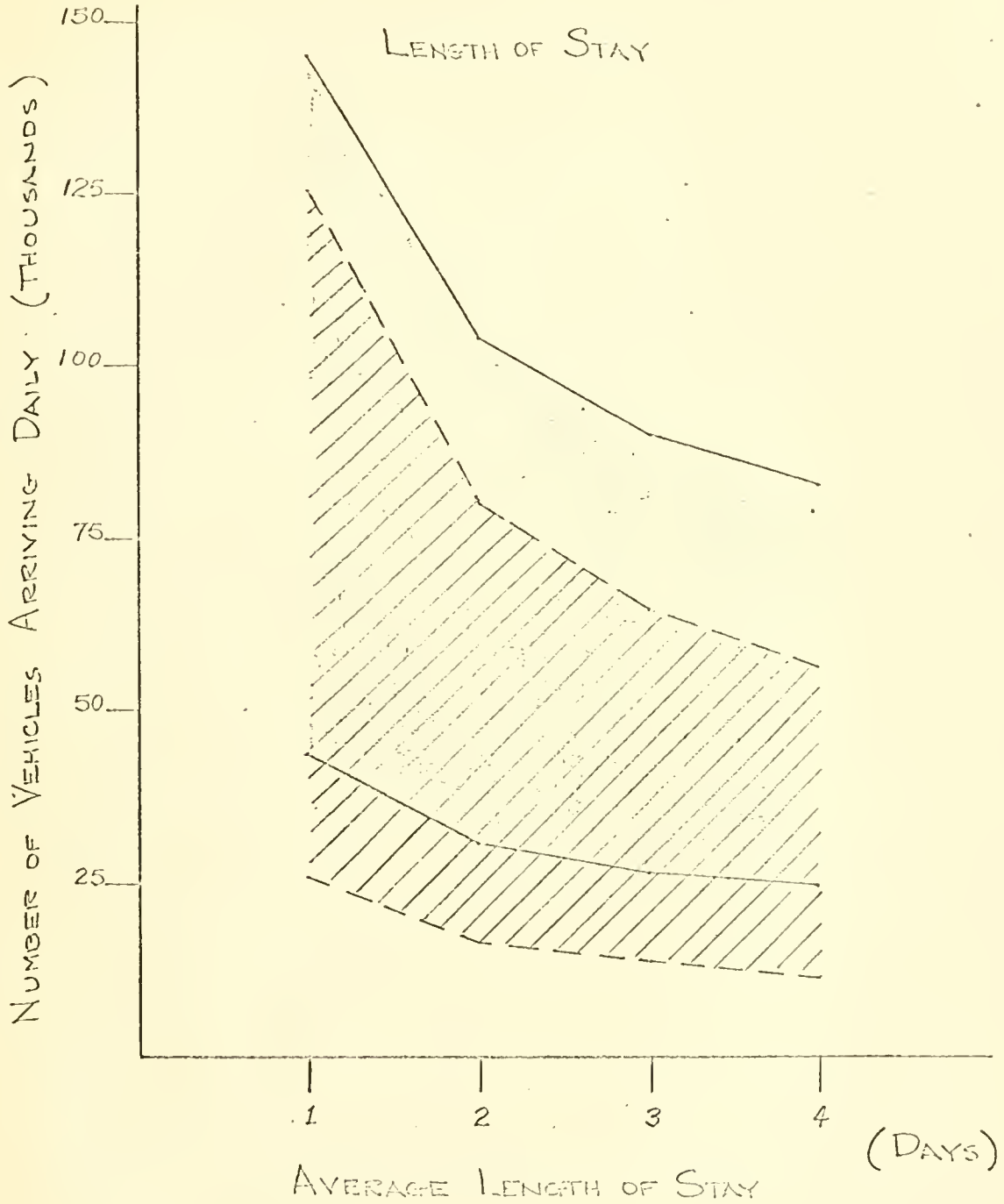
ASSUMED LENGTH OF STAY (APPLIES TO ZONES III & IV) ↓	ZONE I (persons)	ZONE II (persons)	ZONE III (persons)	ZONE IV (persons)	NO. OF VEHICLES (autos)	NO. HOTEL UNITS REQD
1 day	32,000 – 105,000	32,000 – 105,000	32,000 – 105,000	64,000 – 210,000	44,100 – 145,000	Zero
2 days	32,000 – 105,000	32,000 – 105,000	16,000 – 52,500	32,000 – 105,000	31,700 – 104,200	19,200 – 63,000
3 days	32,000 – 105,000	32,000 – 105,000	10,600 – 35,000	21,300 – 70,000	27,500 – 90,300	25,600 – 84,000
4 days	32,000 – 105,000	32,000 – 105,000	8000 – 26,250	16,000 – 52,250	25,400 – 83,500	28,800 – 94,750

* SEE NOTE IN PREVIOUS TABLE.

FIGURE 2a : AUTOMOBILE TRAFFIC (ARRIVALS)

VS.

LENGTH OF STAY

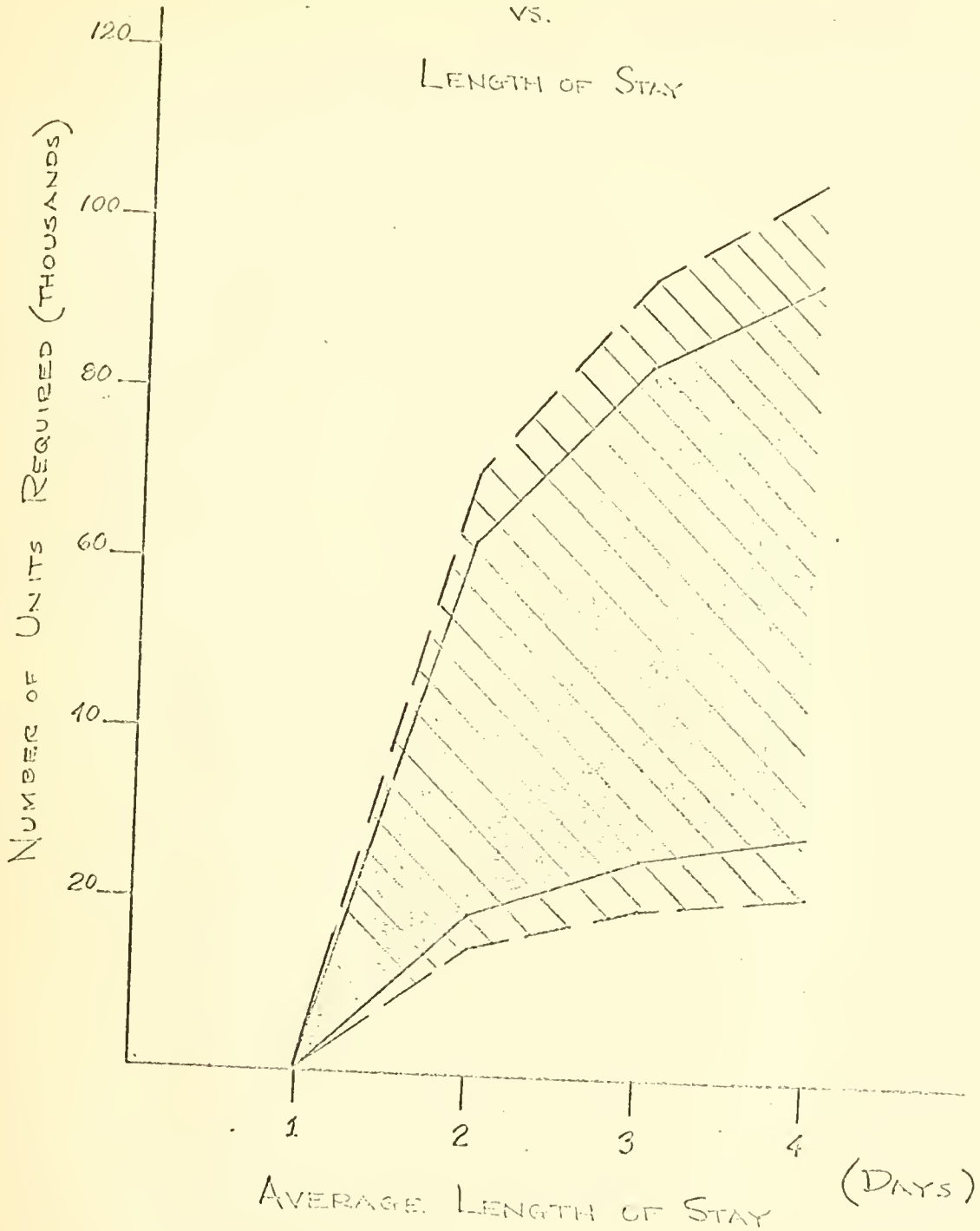


NOTE : SHADED AREAS REFER TO RANGES OF POSSIBLE VALUES :

WEEKDAYS

WEEKENDS

FIGURE 2b: ACCOMMODATIONS REQUIRED VS. LENGTH OF STAY



NOTE: SHADED AREAS REFER TO RANGES OF POSSIBLE VALUES:

WEEKDAYS

WEEKENDS

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